THE

ELECTRICAL REVIEW.

VOL. LVII. OCTOBER 27, 1905. No. 1,457.

ELECTRICAL REVIEW.

Vol. LVII.] CONTENTS: October 27, 1905. [No. 1,457.

	Page
Royal Traffic Commission: Advisory Engineers' Report ...	661
Regenerative Control of Electric Tramcars	663
The Olympia Electrical Exhibition (*illus.*) (*continued*) ...	664
Our Legal Query Column	669
Correspondence	670
Milan International Exhibition, 1906	673
Business Notes	673
An Experimental American Electric Railroad (*illus.*) ...	679
Independent Condensing Plant for the Scottish Co-Operative Wholesale Society (*illus.*)	681
City Notes	688
Electric Tramway and Railway Traffic Returns	690
Stocks and Shares	690
Share List of Electrical Companies	691
Exports and Imports of Electrical Goods during Sept., 1905	693
Electric Signalling on the Great Northern and City Railway (*illus.*)	694
Zénobe Gramme, 1826—1901	695
New Electrical Devices, Fittings and Plant (*illus.*) (*continued*)	696
Overhead Construction (*illus.*) (*concluded*)	697
Arc Lighting	699
New Patents Applied For	700
Published Specifications	700

THE

UNIVERSAL ELECTRICAL DIRECTORY

1905 Edition

NOW READY.

PRICES (POST FREE) IN

United Kingdom.. .. 14s. | U.S.A. (duty free) .. 18s.
British Colonies.. .. 15s. | Other Countries .. 16s.

Order at once.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone No. 933 Holborn; 4425 Central.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION
of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free, per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

ROYAL TRAFFIC COMMISSION: ADVISORY ENGINEERS' REPORT.

ABOUT three months ago we discussed at some length the report of the Royal Commission appointed to inquire into the means of locomotion and transit in London, and to report on the measures for their improvement, and it will be remembered that the recommendations made by the Commissioners were in many respects admittedly based upon a report made by an advisory board of engineers presided over by Sir John Wolfe-Barry, one of the members of the Commission, and composed in addition of Sir Benjamin Baker, and Mr. William Barclay Parsons, chief engineer to the Board of Rapid Transit Railroad Commissioners of the City of New York. This report we have now had an opportunity of perusing, and for the edification of our statistical-minded readers, can inform them that it contains over 100 maps, plans, diagrams and tables, and about 120 pages of letterpress, together with several pages of a summarised index of recommendations; it is also accompanied by a bulky appendix containing many additional maps, plans, tables, &c., the compilation of which must have demanded an immense amount of labour. The terms of the reference to the Advisory Board were very wide, and gave it practically a free hand to make what suggestions it liked for improving and adding to the existing facilities offered by railways, tramways and streets. The eminent engineers composing the Board have interpreted this reference in a most catholic spirit, and cannot be accused of having shirked dealing with any single point; as a result they have, to quote the Horace of our schooldays, produced a monument more lasting than brass, though we very much doubt whether the circulation of the said monument will equal that of the Roman poet's productions. In dealing with the problem referred to its consideration, the Board occupied much of its time in elaborating a prohibitively expensive scheme for the remodelling of London, and quotes with approval the great work undertaken in Paris on the initiative of M. Haussmann. In this connection, it is interesting to read an article on the Paris Budget which appeared in the *Daily Chronicle* of October 20th, 1905, from the pen of Dr. Paul Brousse, the President of the Paris Municipal Council, on the occasion of his visit to the London County Council, from which it appears that "Paris has had to borrow largely for the work of transformation which it has experienced under municipal government—the opening up of its great streets and boulevards, the completion of its sewers, the construction of waterworks, the building of innumerable schools. The debt, roughly speaking, amounts to not less than 2½ milliard francs. Its working expenses, interest, &c., alone involves an annual outlay of more than 127 million francs." This means that Paris pays over £5,000,000 per annum for charges upon a debt, a large amount of which was incurred in Haussmannising the city.

It seems that it is into extravagance of this nature that the Advisory Board would lure London; it urges that two main avenues should be built at a cost approximately estimated at from 25 to 30 million pounds sterling, in addition to innumerable minor improvements costing in all hundreds of thousands of pounds. We venture to think that it is not in this direction that we must look for improvements in London street facilities; for, though we quite agree that the matter must be accorded a broad and comprehensive treatment, we cannot but feel that to rush headlong into a scheme involving so vast an expenditure would be nothing less than criminal in view of the enormous debt which has already been laid upon the shoulders of the ratepayers.

It is in regard to the construction of tramways that the conclusions of the Advisory Board are most noteworthy; for it is to this form of transit that it gives its adhesion. So emphatic, indeed, are the views on this subject, that the Board may be said to plump for tramways which are to permeate the West End in all directions, and even to encroach on the sacred precincts of the City. We ourselves have repeatedly advocated the rapid development of electric traction throughout the County of London—but not on the underground conduit system—and in view of the extravagant propensities of the L.C.C., we cordially concur in the suggestion that for the purposes of obtaining a centralised administration, all tramways should be worked by a lessee company, and the present chaotic condition of affairs abolished.

With regard to the recommendations on railways, we have no criticisms to make apart from those already put forward in respect of the "Main Avenues," and we are in hearty accord with the suggestion that tube railways should have a right of easement under private property analogous to that possessed by the London County Council for tunnels utilised for main drainage purposes; no doubt it would then be possible to build the cheap tube railways referred to by the Board, and so to connect North and South London.

In conclusion, we would merely reiterate what has already been made clear, namely, that the great bulk of the recommendations contained in this report are, if not absolutely impracticable, at least out of all proportion to the requirements which they are supposed to meet; it would be a wiser plan to proceed at once with the work lying ready to our hands, while not losing sight of the vast improvements which may be, and ought to be, carried out in the future.

Christmas Boxes.

"Christmas comes but once a year, and when it comes it brings good cheer"—but where should the good cheer come from? The National Electrical Manufacturers' Association do not seem to be quite agreed upon the answer to that question. A discussion on the subject was reported in our last week's issue. "The trade was unanimous in its desire to save money on Christmas boxes, but all must agree to stop sending them," said, in effect, the gentleman who introduced the subject. "Christmas boxes were a part of business competition," said another. A third desired to make distinctions. "There were cases where Christmas boxes should be given—for instance, to certain men who had nothing to do with the placing of orders: men who went out of their way to do one little services. Presents to such men were in no sense a bribe. He had on his books for Christmas boxes people with whom they did no business at all—men who had retired, for instance." We are afraid that to deal with the Christmas Box question on the basis of its brighter side is impossible now. We all know the inestimable value of the intrinsically worthless little present that keeps friendship's memory green, and we all hope that the time is far distant when there may be no friendships amongst business acquaintances. But there is nothing in common between the friendly interchange of thoughtful presents and the wholesale distribution of "good cheer" prevalent at the Christmas season. The modern business Christmas box is an application of an ancient and honourable custom which is degrading alike to the giver and the receiver. The gift emanates from a seller, and the effect, if not the intention, is to place a buyer—or the representative of a buyer—under an obligation to that seller. The givers of the gifts do not seem to see their way clearly to a cessation of the practice. We wonder whether the receivers could help to right matters? There are many officials who chafe at the receipt of a valuable present from a firm with whom their employers are doing business, but they hesitate, from feelings of delicacy, to return such presents. We hope that the sentiment of self-respect may override such misplaced delicacy. When the recipient realises that his Christmas good cheer is just "a part of business competition," he may the more readily appreciate its degrading aspect.

On Thermometry.

The validity of a boiler test depends to so large an extent on the accuracy of the various readings of the temperature of feed water, steam and flue gases, that it is thought that the following remarks relative to the use of the thermometer may be of interest. On a first introduction the thermometer would seem a most simple instrument, but a very little practice with it proves it to be as full of tricks as the proverbial monkey.

The conditions under which most boiler tests have to be run generally preclude the possibility of a greater accuracy than 1 per cent. in the readings, so that all questions of calibration may be dispensed with, providing the thermometer is in good working order.

For the feed water an instrument having a maximum reading up to, say, 250° F. will generally be found sufficient. The usual method is to strap this to the feed pipe near the check valve by means of asbestos cord, and well pack the bulb with the same, taking care that the bulb itself is actually in contact with the pipe. A better arrangement is to cut a hole in the lagging at the side of the feed pipe and lay the thermometer in this, with the bulb against the feed pipe, tying it in place with asbestos packing, as before. It will be found best to place it about a yard or two away from the check valve, as thermometers have been broken, through a leaky check, when the pump has been shut off. In this connection we may note the necessity of providing spare instruments, otherwise a test may fail for the want of them.

Steam temperatures are taken at the boiler side of the stop valve, with the aid of a brass pocket let into the steam pipe. This pocket is often filled with cylinder oil. Now the cylinder oil, being a bad conductor of heat, does not attain a uniform temperature, as may be easily proved. The temperature in the centre of the oil is often as much as 10° below the temperature as measured with the bulb at the side of the brass tube. This is a point worth noting. A better arrangement would be a combination of mercury and oil, say an inch of mercury in the bottom, with the rest of the tube filled with heavy oil. The thread of the thermometer should be only just visible above the oil when taking a temperature reading. If the thermometer be not left in the oil during the whole of the test, it should be inserted at least two minutes before each reading. Previously to this the mercury column should be examined to detect any possible discontinuity in it. If found to be split, it may be renewed by gently jerking the thermometer, taking care not to break it by the impetus given to the mercury in the bulb. This

splitting may be due to either prolonged heating or overheating of the mercury, or to sudden cooling. A thin thread is far more easily ruptured than one of larger section.

The best place to take the temperature of the flue gases is immediately beyond the boiler setting, and if a bolt be removed or a $\frac{1}{4}$ in. hole drilled in the side of the flue, the thermometer may be easily inserted. Of course with brick flues it may not be possible to get a thermometer to work, in which case recourse must be had to a pyrometer. As regards the selection of the position of the thermometer—a most important point—care must be taken that the bulb is actually in the full current of the gases, or reliable readings cannot be obtained. It may happen that a bend in the flue, or the proximity of a damper, may so deflect the gases as to shield the thermometer effectively. This must be guarded against. For both flue and steam temperatures the same thermometer may be used—reading to about 600° F., depending chiefly on the steam pressure at which the boiler is working—though two thermometers will be found more convenient. The instrument should never be held horizontally when taking a reading—or during cooling: the bulb should always be lowest, or the readings will be valueless. It will be found best to keep the thermometers in the heat only just long enough to obtain a proper reading—itself a matter of minutes—as otherwise local heating of the mercury may cause the thread to split or even disintegrate into small bubbles, rendering subsequent reunion difficult. Indeed, it may be necessary to heat the instrument to the full temperature and allow it to cool slowly with the stem vertical. Further, deformation of the bulb may result from prolonged heating at 400° to 500° F. In ordinary use the thermometer may take days to return to its proper state.

It should be remembered that of all the numerous data collected during a boiler test, readings of temperature must, above all others, be accurate.

The Hall Road Collision.

In the report of Lieut.-Col. Druitt, R.E., to the Board of Trade on the disastrous collision which took place on the Lancashire and Yorkshire Railway on July 27th, both the driver and the signalman are held to blame, for both deliberately broke the regulations laid down for their guidance; had *either* obeyed instructions, the accident could not have occurred! What conceivable system of signalling could possibly have guarded against this double dereliction of duty? The only lesson to be learnt from the calamity, says Col. Druitt, is the very old one—the necessity of complying exactly with all rules and regulations, and of subordinating punctuality and fast running to safety requirements.

As regards the danger of facing-points, the report states that this danger does not exist with the safeguards specially introduced to prevent a signal from being lowered to the safety position when the points are wrongly set. In view of the accident which actually took place, in spite of the most elaborate precautions of this nature, it is difficult to accept this statement. If trailing points had been used, that accident could not possibly have occurred. No doubt, as Col. Druitt observes, the use of trailing points would conceivably necessitate the blocking of the main line for a longer period—perhaps one minute; but, in his own words, "Fast running must always give way to safety requirements."

The one satisfactory deduction from the accident is the fact that electrical operation was in no respect whatever to blame. No electric shocks were received, and there was no fire, nor, in the opinion of the Inspector, is there any extra danger of fire due to the use of electricity.

We regret that Col. Druitt does not see his way to recommend the use of a buffer compartment at each end of the train; nor does he suggest any modification of the design of the cars. The corridor coaches have very strong and heavy underframes, but the bodies are light and almost independent of the frames; hence the peculiar character of the accident, in which the unfortunate passengers were practically ground between the two frames. Provision might be made for preventing the telescoping of the cars, by means of very strong vertical frames at the ends, preferably arranged so as to divert the force of the blow sideways rather than to meet it absolutely end-on.

REGENERATIVE CONTROL OF ELECTRIC TRAMCARS.

In our last issue we propounded in effect the question, Why is the regenerative control of electric tramcars regarded with apathy and indifference, in the face of its proved economy and efficiency?

Many possible solutions to this problem may be advanced. Foremost, of course, is the established custom of the Briton to adhere to ancient usages, and to look upon new propositions with suspicion readily merging into hostility. It must be admitted that the engineer or manager who has had experience with only one system, or none at all, cannot be censured for pursuing the beaten track, in which course, moreover, he will have the hearty support of the majority of manufacturers and contractors who, for obvious reasons, are loath to take up new ideas which they have not themselves originated. Such engineers are "wise in their generation"; but that is a standard of mediocrity, and is not aimed at by the man who is determined to rise above the average level.

Part of the inertia is doubtless due to unwillingness to change existing equipments. There is less excuse for this attitude, for the expense is inconsiderable compared with the capitalised value of the saving effected, apart from the collateral advantages gained. We believe we are within the mark in stating that the cost of converting an ordinary series-parallel equipment to regenerative control, on a car in regular service, will be recouped within the first two years of running. Moreover, there is no need to dislocate the service in the slightest; one car can be taken in hand at a time, if necessary, and put in service again without interfering with any other thing. The cost would properly be charged to revenue, and, as above stated, would be repaid in two years or less.

Another adverse factor is the difficulty of inducing the men in authority to take the question seriously into consideration. Things may be going on smoothly; their accounts show a balance on the right side; series-wound motors are still in fashion. Why suffer the trouble and inconvenience of thinking about the matter? But this is not the attitude of the man who is wide awake and on the alert to seize every possible means of improving the undertaking under his charge, of reducing running costs, and of increasing the comfort and safety of his passengers.

Lastly, we fear we must add, without the slightest intention to offend, that there are men in charge of tramway systems—capable and efficient managers, indeed—who nevertheless are not in possession of that technical knowledge which is necessary in order fully to comprehend the advantages of the regenerative system of control. To such a man it is useless to speak of acceleration, regeneration, kinetic energy, inertia—he is apt to look upon such things as merely "theoretical" considerations, with which he has no concern. As it happens, however, an adequate understanding of these and similar matters is indispensable to the obtaining of the best results. No matter how well a tramway undertaking may progress under the direction of a non-technical manager, it is an absolute certainty that a manager of equal commercial ability, who possesses in addition a competent engineering knowledge, will be able to obtain far better results, which will be reflected in the increased profits.

Turning to the actual system, let us see what is claimed on its behalf. We may premise that descriptive articles have frequently appeared in our pages,* relating to the two systems which are in existence, viz., those of the Raworth's Traction Patents, Ltd., and the Johnson-Lundell Electric Traction Co., Ltd., and we shall therefore confine our remarks to the advantages of the regenerative principle, as already demonstrated in actual practice.

The saving in electrical energy varies with the nature of the line, and appears to be from 15 per cent. on level lines to 30 per cent. or more on hilly routes, as measured by watt-hour-meters on the car. But what does this mean precisely?

The cost of energy is calculated upon the basis of the output from the main bus-bars; where it is purchased, the

* Electrical Review, July 17th, 1903, p. 119; July 24th, 1903, p. 138; August 12th, 1904, p. 244; July 21st, 1905, p. 105; August 4th, 1905, p. 168.

price paid varies generally from 1·25d. to 2d. per unit, and even higher prices are not unknown. The line losses may be estimated at 10 per cent. with direct supply, and at least 20 per cent. if given through rotary converter sub-stations. Assume, now, that an ordinary car consuming 1·25 units per car-mile is replaced by a regenerative car consuming only 1·0 unit per car-mile. The saving at the car is 0·25 unit, but this is equivalent to a saving at the power station of 0·28 unit in the first case and 0·31 unit in the second. Hence, if energy is purchased at, say, 1·5d. per unit delivered at the D.C. bus-bars, the saving per car-mile is no less than 0·42d. in energy alone.

Take, for example, a system such as that of the Salford Corporation. The capital expenditure amounts to more than £638,000, and the traffic revenue to £210,000. Capital charges amount to £38,000, and running costs to £135,000, for 4,884,590 car-miles run. The energy used per car-mile is 1·41 units, at 1·5d., or 2·11d. in all. Saving 20 per cent. of this by the adoption of regenerative control, the economy is 0·42d., equivalent to an increased surplus of £8,550 per annum, or nearly 1·4 per cent. on the whole capital outlay.

But this is not the whole saving. The diminished output implies diminished losses throughout the whole of the feeder system, and as the losses vary as the square of the output, the effect of reducing the latter by 20 per cent. is to reduce the line losses by 36 per cent. An original loss of 10 per cent. therefore becomes 6·4 per cent., and this in the case of Salford, with an annual output of nearly 7 million units, means a saving of £1,580.

Again, the maximum demand of each car is reduced to a remarkable extent, solely on account of the system of control, and, therefore, the variations of load on the power station are also much less than with the ordinary system; as the actual mean load is at the same time diminished, the result is that at least one-fourth of the generating plant can be shut down, whilst maintaining the same service as before. The remaining sets are more uniformly loaded, and therefore more economical, so that a still greater economy of fuel is obtained, besides a reduction in labour, and in wear and tear.

The saving in repairs on the cars—amounting to no less than six-sevenths of the ordinary cost at Birmingham, as ascertained by actual comparative tests on 28 cars, and vouched for by Mr. J. A. Lycett, director, and Mr. G. Conaty, engineer and manager, of the Birmingham and Midland Tramways Joint Committee—is mainly due to the use of the motors as regenerative brakes, whereby the wear and tear of wheels and brake blocks is enormously diminished. The brakes are only used to hold the car at a standstill, not to retard its motion, hence flats on the tires are abolished.

At the meeting of the Association of Tramway and Light Railway officials last year, tramway engineers who had tried the system spoke in high favour of it, the only objection put forward being the larger size of the motors. This objection no longer exists; the same frames can be used as for series motors. The freedom from jerks and strains in starting up is so marked, that passengers show a decided preference for regenerative cars: this is not surmised, but actually observed. Drivers are relieved of the monotonous and laborious labour of putting on the brakes by manual effort—a thing which, as we have often urged, is hopelessly inadequate and out of date in these days of high-power cars.

A singular and unlooked-for feature of the regenerative system is the reduction in accident claims. The car with series motors can be run with economy only at full speed or half speed; consequently, its progress in traffic is marked by a series of little spurts, whereas the regenerative car can be run at any desired speed without waste of energy, so as to adapt its rate precisely to that of the vehicles in front of it.

One other point we must touch upon—the question of sparking. It is sometimes suggested, as an objection to the regenerative system, that the motors must necessarily spark when the field is weakened. But this is so obvious a fallacy that it ought not to need disproof. Take a case: the series winding of a traction motor is removed, and a shunt winding substituted. The original armature is retained. Now, at full speed—the same full speed as before—the counter E.M.F. of the armature must be almost the same as before, and therefore the magnetic flux must also be almost the same as before. Hence the sparking conditions are practically the same as before, and if the series motor did not spark, neither will the shunt motor. What does it matter whether the field is produced by shunt or series windings, so long as the magnetism is there?

The only difference in the two cases is this: in the shunt-wound motor, the counter E.M.F. must be greater than in the series motor, by the amount of the drop in the series winding, which is absent in the former. Hence, at the same speed the field is stronger in the case of the shunt motor than in that of the series motor, and consequently the conditions as regards sparking are, if anything, *improved!*

But anyhow, regenerative cars have really been running too long for such simple questions of fact to be raised. The motors do not spark; what, then, is the use of saying that they *must* spark? Both theory and observation refute the proposition.

No fewer than 28 cars have run for three months on the Birmingham tramways, actually realising all the advantages herein claimed by us for the system, and we have reason to know that the directors and manager are at this moment firm believers in its merits, as they were three months ago.

We have recounted these advantages of the regenerative system of control, not with any wish to thrust the system down the throats of our readers, but with the view of arousing their interest in it, and awakening them to the great importance of the subject. If any dispute our contentions, let them endeavour to refute them. Our "Correspondence" columns are open, and any fair and *bonâ fide* criticism, for or against, will be welcome.

THE OLYMPIA ELECTRICAL EXHIBITION.

(*Continued from page* 626.)

The Electric Cookery Appliances Competition at Olympia.

The following is a copy of the award of the Judges in this competition:—

October 20th, 1905.

The Judges award the prizes, offered by the Executive Committee, as follows:—

I.—For the best Apparatus to fit up a complete Kitchen.

A First Prize of £50 to Messrs. Veritys, Ltd., of King Street, Covent Garden, W.C., for the "Aston Electra" apparatus.

A Second Prize of £20 to the British Prometheus Co., Ltd., of 18, London Road, Kingston-upon-Thames.

II.—For the best Single Piece of Apparatus.

A First Prize of £20 to the Dowsing Radiant Heat Co., Ltd., of 24, Budge Row, Cannon Street, E.C., for an electric oven, containing three different methods of heating.

A Second Prize of £10 to the British Prometheus Co., Ltd., of 18, London Road, Kingston-upon-Thames, for an electric oven.

The Judges further recommend to the Executive Committee that a special extra prize be awarded to Mr. Henry Dowsing for his design of a completely-equipped kitchen.

(Signed) W. H. Preece.
Sydney W. Baynes.
Sydney T. Dobson.
J. E. Edgcome.
C. O. Grimshaw.
H. W. Miller.

Dowsing Heating and Cooking Exhibits.

There were several separate exhibits of Dowsing heating appliances. At one stand near the Addison Road entrance was an imposing bank of radiators made by the Dowsing Radiant Heat Co., Ltd., but it was in the annexe at the other end of the building that one found the more striking and interesting displays. One of these consisted of a room fitted up as a model of an up-to-date medical institution for electrical and physical treatment. Here there were, of necessity, many things that are already well known to our readers, including the Solarium electric sun bath, for light and heat treatment; a bed showing how the Dowsing treatment is applied; high frequency apparatus made by Messrs. Watson & Sons, of High Holborn; a portable ozonising apparatus; a vibrator for massage treatment, and so on.

A contiguous stand contained an electric light and heat disinfecting apparatus, supplied by the Dowsing Radiant Heat Co., Ltd., for cleaning beds, mattresses, blankets, clothing, carpets, and so on. This disinfector has a large metal chamber 7 ft. high × 9 ft. long × 6 ft. wide, with a rotating cage in five

sections, revolved by means of a 1 H.P. electric motor placed at the back. In the several sections of this cage, blankets, &c., are placed, and the motion of the cage brings the object fully under the

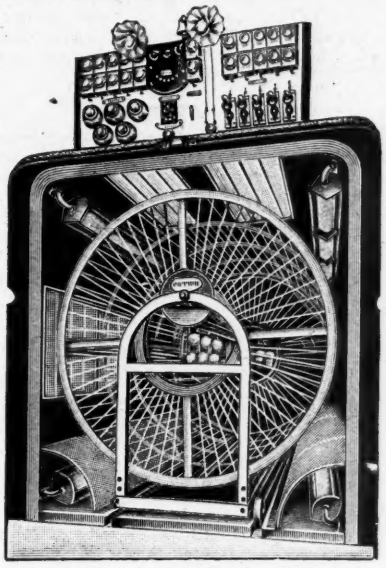


Fig. 115.—The Dowsing Disinfector.

influence of the light and heat of the Dowsing lamps, which are located from end to end at the four corners of the iron chamber and at the centre as shown. The bad air is drawn out through a suction pipe at the back, and pure air admitted.

and easy to work, is composed of two principal parts—(1) the aspirator, with motor and suction arrangement, and (2) the separator, or dust filter. A small electric motor of about $\frac{1}{6}$ H.P. is used. The brushes, which are attached to a hollow pole like a broom handle, or moved by hand, are bell-shaped in form, having the bristles arranged around the outer rim in such a manner that the air can pass freely through them. The suction produced in the centre of the brush by the motor, draws into the receptacle the dust, dirt, fluff, &c., removed in the sweeping. There is no possibility of the tube getting choked, and the cleaning of the brushes is very easy. India-rubber brushes are used for fragile objects, furniture, &c. The bristles can be readily renewed when necessary. The air being loaded with dust is caused to pass through a separator provided with a number of cells for retaining the dust, after which the filtered air is passed through a canvas bag out into the open. If required, the receiving chamber can be made of metal and provided with a disinfecting fluid, thus deoderising all substances as they enter. The mechanical part of the apparatus, provided with motor and exhauster, can be used as a ventilator, or if reversed, can be employed to deliver hot or cold air into the room.

In the accompanying photograph, fig. 116, we show a model electric kitchen, which was fitted up in the annexe, to the design of Mr. H. J. Dowsing, M.I.E.E. The kitchen served to show at a glance the comprehensive manner in which electricity carries out every requirement in this department of the house. Not only does it produce the heat for cooking, but it also provides power for carrying out various laborious exercises, such as knife-cleaning, boot-cleaning, polishing, &c. As there is no combustion, there are, of course, no products of combustion to get rid of. But the vapours and smells arising from cooking operations require to be dispersed and be drawn out of the room. This is done by means of the electric fans, one of which is fixed in the centre of the room and the other at the back, being placed at a convenient height for removing foul air. Although there are ample appliances for all purposes, the room itself did not look at all over-crowded or in a disorderly condition, for it is unnecessary to crowd the cooking utensils on to the fireplace or even near it.

Some of the saucepans, kettles, &c., are self-contained, *i.e.*, they have heating arrangements attached to the vessel itself, so that it may be used anywhere. Other utensils of the ordinary kind can be used on an electric hot-plate. This hot-plate is of a new pattern,

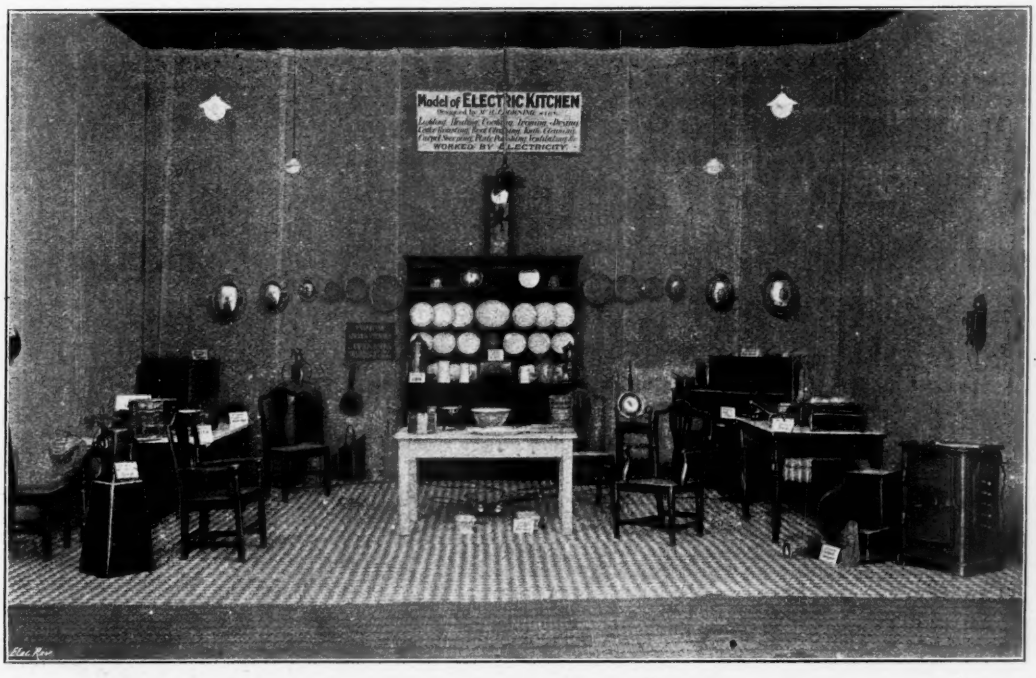


Fig. 116.—The Model Electric Kitchen at Olympia.

The electric disinfector is claimed to constitute one of the greatest advances in sanitary science and hygiene. The process has the effect of destroying completely, without the use of steam or chemicals, the germs of disease; and thoroughly cleaning the articles which, under the process, are submitted to the simultaneous action of light and heat rays, the temperature reaching as high as 300° to 350° F. The electric disinfector may also be used for treating articles which are moth-eaten, as the light and heat will kill the insects and their eggs. The same operation removes all moisture and residue of perspiration, and makes the articles treated odourless. The illustration (fig. 115) shows the switchboard on top, but the disinfector is not now supplied in that way.

The Dowsing Radiant Heat Co., who supply these disinfectors, also make the "Universal"-electric sweeper, cleaner and ventilator (Bonis patent). This apparatus, which is light, strong, portable,

and reaches a degree of heat hitherto unattainable. It can readily be made as hot as the top of a kitchener, and will then cook as a easily as a gas ring. It will boil, fry, grill, and toast with the ordinary appliances of the kitchen, and as there is no combustion these cooking operations can be carried on in any convenient position; in fact, they may be arranged on the table while the cook is busy preparing other things for cooking. The large electric plate standing on the left-hand side of the dresser, will keep a large number of dishes hot, and as it can be regulated by turning on more or less of the heat lamps which are used to produce the heat, great economy can be practised with its use. Radiant heat lamps are used, and the heat rays are thrown upwards on to a thin iron plate, which readily transmits the heat to the vessels standing thereon.

Standing on the hot plate is a Bain-Marie with three saucepans

of different sizes; here, again, the radiant system is used, and the usual hot water bath is dispensed with, the lamps keep it at a very even temperature, and the cooking is carried on with little attention.

The electric oven is placed near the large hot plate above referred to, and is very easy of access. The inside plates of the oven are heated by means of "Huntley's" detachable elements. At the top of the oven are four large heat lamps for throwing down powerful heat rays when required. This is to produce the "browning" or "salamander" effect required to complete the cooking operations.

The roaster fitted with jack is made complete in itself. The front of the roaster, which is usually exposed to the fire, is fitted with five large heat lamps, and a special form of reflector throws the rays upon the joint as it rotates in front of them. Here, again, the convenience of the self-contained heating arrangement is evident, as the roasting may be carried on in the middle of the room if necessary. It is found that meat cooked with a luminous heat is roasted as well as in front of a large fire, but is cooked through in a much better manner.

Electric fish kettles, saucepans, urns, small hot plates, frypans, electric warming pans, and foot warmers and other appliances are also in evidence, and the ease with which they carry out all work, and the perfect cleanliness of the heating arrangements, make the system of electric cooking far preferable to all others.

In a kitchen it is necessary to provide means for drying and airing, and the electric towel airer shows the great convenience with which electricity can be applied for such a purpose.

Electric power is employed in the form of an electric knife-cleaning machine, a boot-cleaning machine, and a plate polisher, the latter being a most useful appliance which is not always to be found in the kitchen. With it, three parts of the labour of polishing is done away with, and electricity carries out the operation in a few minutes. The article to be polished is simply pressed againstthe buff, which is rotated by the motor at a very high speed.

An electric fan is placed in the centre of the kitchen which keeps the air in motion. The electric fan fixed in the back wall is for the purpose of drawing out the foul air from the kitchen.

We have already mentioned the electric sweeping and cleaning machine. A luminous electric radiator is used for warming purposes. In this room a telephone is used also an electric clock, thus completing the whole arrangement of this up-to-date electric kitchen.

Appliances were received for the equipment of the kitchen from the following firms:—The Dowsing Radiant Heat Co., Ltd.; the Edison & Swan United Electric Light Co.; Electromotors, Ltd.; the General Electric Co., Ltd.; Keith, Blackman & Co.; the British Prometheus Co.; and the Crypto Co.

W. McGeoch & Co., Ltd.

Messrs. McGeoch's specialities consisted largely of ships' fittings, a varied selection of which were seen on their stand.

An interesting exhibit was the Duplex patent ship's light indicator, a compact water-tight apparatus suitable for exposed situations, and designed for use with twin filament lamps. On the front of the case were a series of windows representing the various signal lamps

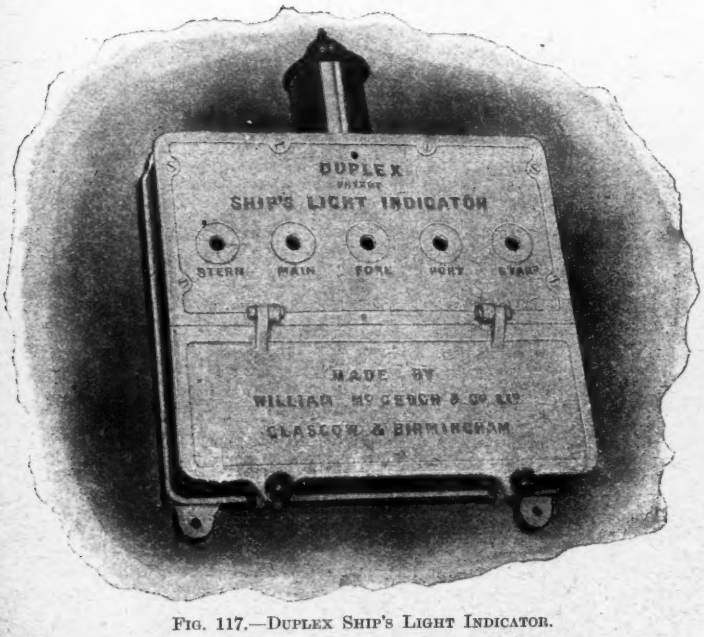


Fig. 117.—Duplex Ship's Light Indicator.

of the ship, and an additional "pilot" lamp window, to show that the illumination of the indicator is in order. When all is in order, no light appears at the signal windows. If one filament of a signal lamp burns out, the window corresponding shows a half-red light, and should both filaments fail, the corresponding window is completely illuminated, showing an all-red light, while an indicator bell rings until switched off by the switch controlling the faulty lamp.

In addition to the above, the firm are makers of tramway and electric lighting and heating fittings, while an electric ozoniser also figures prominently among the exhibits.

The Synchronome Co.

Not the least interesting and useful of the Olympian exhibits was the system of electric clocks, installed by the Synchronome Co. by agreement with the management. There were 20 clock dials in various positions in the Hall, the Annexe, refreshment rooms, &c., including two skeleton iron dials 6 ft. in diameter, suspended from the roof at each end of the Hall. These dials are fitted with transparent plate-glass centres, and their hands are propelled by a mysterious and invisible agency, which really consists of the "One-wheel" step-by-step movement, concealed by the bosses of the hands. All these clock dials are operated simultaneously by one self-wound controlling seconds pendulum in the Entrance Hall, which combines the functions of an accurate timekeeper and a switch. The mechanism is similar to that which we recently illustrated in connection with the "inkless recorder," and which is made under Mr. Hope-Jones's patents; the switching mechanism is so designed as to ensure perfect contact at half-minute intervals, while not in any way interfering with the perfect timing of the pendulum, to which it imparts an impulse at the same time. The latter is of invar, and is compared daily with the Greenwich Time Signal, so as to ensure accuracy of time-keeping throughout the Exhibition. Not one dial has varied from another, though, unfortunately, an interruption of the circuit was caused by the erection of advertising signs on the Gallery—a mishap in no way attributable to the system.

At the stand of Messrs. Verity, Ltd. (to whose exhibit space will be devoted in a later issue), the Synchronome Co. exhibited a number of dials of various kinds, operated by a "Synchronome" self-wound controlling seconds pendulum with dead-beat escapement. Workmen's time recorders, a recording ("Inkless") voltmeter, and a self-wound clock were also exhibited.

W. Lucy & Co., Ltd.

Messrs. Lucy & Co. showed a variety of interesting apparatus of ingenious design and adapted to divers purposes. The firm hails from Eagle Ironworks, Oxford, and castings for tramway and electrical purposes generally are a staple product.

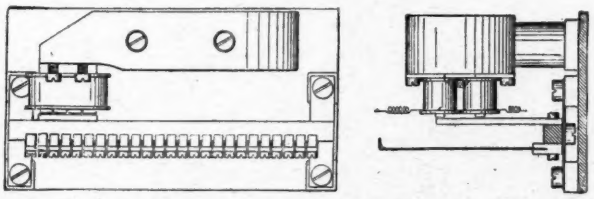


Fig. 118.—Mechanism of the Frequency Indicator.

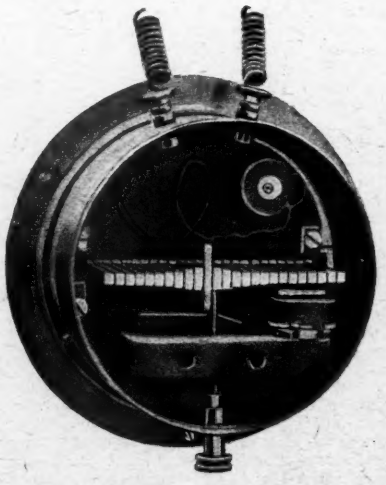


Fig. 119.—Frequency Indicator.

The stand, however, contained some ingenious special appliances, among which we may mention some adjustable metal shelves,

adapted for stores, warehouses or free libraries ; these are, of course, fireproof, and lend themselves to rapid readjustment and economical storage.

A fountain brush for tramcar cleaning, in which the water is led up the brush handle and percolates through small holes among the bristles, is an item which will interest all who possess cars, carriages or large window surfaces. Tariff and time switches, and a novelty in speed indicators, are also on view. The latter we illustrate (fig. 119) in the form of a frequency indicator, as shown at work on the stand. It consists briefly of a series of vibrating reeds attached to a flexible diaphragm, which receives its motion from a couple of small electro-magnets, energised by an alternating or interrupted current.

The diagram (fig. 118) explains itself. The device was shown in England for the first time on Messrs. Lucy's stand at the Exhibition.

In addition to the above, an exceedingly novel and practical arc lamp lowering gear, constructed by the London Electric Firm, was on view. The suspension device is so simple that one wonders why

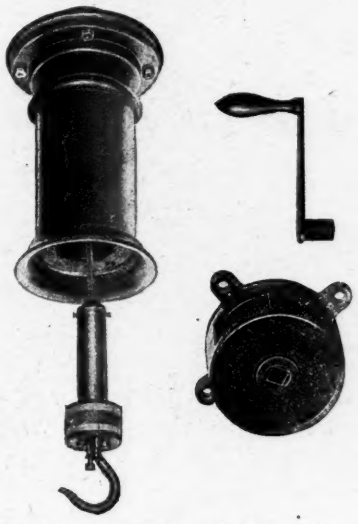


Fig. 120.—Arc Lamp Suspension Device.

Fig. 121.—Arc Lamp Winch.

it was not thought of long ago. The pins on the plunger (fig. 120), when the latter is drawn up into the case, are practically trapped in a zig-zag groove, which takes the weight of the lamp; a further lift frees the pins from the groove, allowing the plunger to drop out of the case.

The accompanying winch (fig. 121), is self-sustained in all positions; it contains a most ingenious gear, which we shrink from describing, but which is admirably adapted for the purposes in view. There is a gear ratio of 4 to 1 between the handle and the drum, and no pawls or gear wheels (in the ordinary sense) are embodied in the mechanism.

Crompton & Co., Ltd.

The big reductions in price for energy for power purposes induced Messrs. Crompton to specially exhibit their continuous and alternating current motors in all sizes, from ¼ h.p. upwards.

All these motors are built on standard lines.

The exhibit included a single-phase lift motor of the reactance type, designed to start against heavy loads with low-starting current. The machine will give 10 h.p. under ordinary lift conditions, and runs at a speed of 750 r.p.m. The rotor is of the usual construction, provided with three-phase star-connected winding, the neutral and the free ends of the winding being connected to a special form of slip-ring. There are three or more of these rings; on each ring is fitted a number of insulated bars equal to the number of poles on the motor, and spaced equi-distantly on the rings. These insulated bars are all connected to the neutral point of the rotor winding, and the action of the motor when starting is as follows:

When one of the brushes is in a position to connect the insulated bar and ring, it short-circuits one of the rotor phases, and produces a repulsion torque. By properly staggering the brushes on the different rings a continuous repulsion torque is obtained.

The brushes on the rings are also connected to an ordinary starting resistance, this resistance being gradually cut out. As soon as the motor has reached its normal speed, and the starting resistance is short-circuited, the machine acts as an ordinary induction motor, and runs practically at synchronous speed, irrespective of the load. When used for lift or crane work, the motor can easily be reversed by shifting the brush gear through a small angle, and for this purpose the brush gear is connected mechanically to the controller.

With motors of this description a large starting torque is obtained with a small current consumption, and this makes the motors particularly suitable for lift and crane work. Some tests at Messrs. Crompton's works show that the motor is capable of exerting 1·75 times the full load torque with only 1·5 the normal full load current. There is no sensitive or complicated controlling gear, and the machines run absolutely sparklessly. The rotor circuit is quite distinct from the stator circuit, so that the rotor and starting resistance can be arranged for a low voltage.

On another portion of the stand was shown the special starting switch, for use with these motors. A compact motor-driven buffing machine and an ammunition hoist of special design, as supplied to the Admiralty, designed to lift 300 lb. at 180 ft. per minute were also to be seen running.

On the opposite side of the stand were shown two feed pumps of a rather novel design (see fig. 122), which will be particularly interesting to central station engineers. The pumps are driven direct from the motor through worm gear, the motor, reducing gear and pump being all mounted together on a cast-iron box pattern bedplate.

The motors are either shunt or series wound, depending upon the duty of the pump. A bearing is provided at the commutator end of the armature only, the other end being directly coupled to the steel worm shaft, which passes through a packed gland and bearing into the gear case.

The worm shaft is provided with either a double or triple

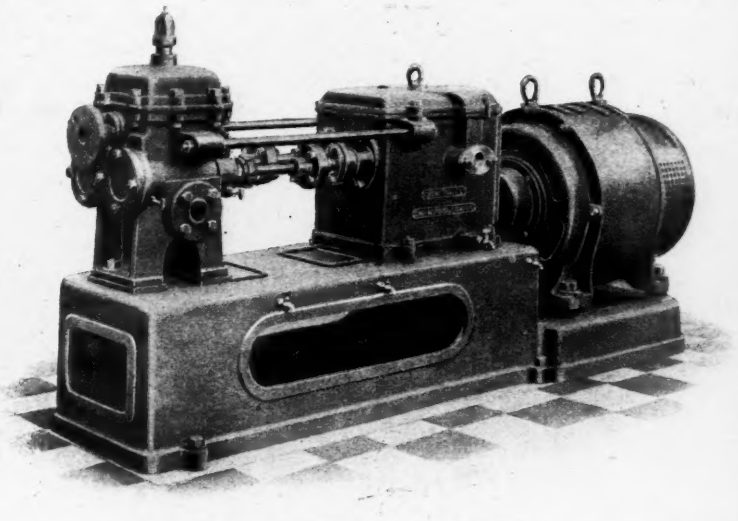


Fig. 122.—Motor-Driven Feed Pump.

threaded worm, and is carried at its inner end in a bearing, terminating with a ball thrust block.

The worm engages in a phosphor bronze worm wheel keyed to a crankshaft. Short connecting rods are coupled direct to the pump piston rods through crossheads running in circular guides. The pump rods enter the pump through similar glands formed on the ends of the pump barrels.

The pump is of the duplex double-acting type, with externally packed plungers ; the gear case forming an oil bath. The pumps are made in three sizes at present, viz., 600, 1,200 and 2,000 gallons per hour, and are all suitable for a working pressure up to 200 lb. per sq. in.; from tests carried out, the through commercial efficiency obtained is rather over 60 per cent.

An air pump shown was of the three-throw "Edwards" type, and was driven by a 3½ h.p. shunt-wound motor through a Humpage, Jacques & Pedersen patent reducing gear, embodied in the design of the motor-end cover, the ratio of reduction being 7 to 1; a special form of flexible coupling is provided between the motor and air-pump shaft.

A portion of the stand was devoted to switchgear, which included a switchboard suitable for controlling a private plant, several examples of the heavy current chopper-type switches, shunt regulators, and a three-phase starting pillar. The circuit-breakers were of a type recently introduced by Messrs. Crompton, manufactured under the Charlton-Barton patents, and are supplied for either maximum, minimum, or reverse control, or for any combination of these. The firm's well-known arc lamps and ceiling fans were also much in evidence.

The Lahmeyer Electrical Co., Ltd.

Practically the only heavy electrical exhibits at the exhibition, were shown by this firm. Prominent among them was a 350-kw. motor-generator, consisting of a three-phase synchronous motor with revolving field for working at a pressure of 10,000 volts, 50 cycles, direct coupled to a 220-240-volt d.c. generator, together with the requisite switchgear for its operation. During the exhibition this set was utilised in the reverse way for supplying three-phase current at a reduced periodicity, to the 100-h.p. haulage gear also shown on the stand. The latter equipment is driven through single-reduction gear by a 200-h.p. three-phase motor having a speed of 187 r.p.m. All the operating levers are centralised and within easy reach of the driver; the controller and reversing contact resistance boxes being oil cooled.

A small, but very interesting, apparatus shown by the company, was an ozoniser, designed for sterilising water. The ozone apparatus can be run from ordinary house wiring, and is connected through a thin flexible metallic tube to a special water tap, on which a diffusing chamber is provided.

The ozone, of course, mixes with the water in the chamber in sufficient volume to effect its sterilisation.

We may mention that the apparatus has attracted the attention of the medical profession, and that a large installation, to give over 5 million gallons of sterilised water per day, is in course of erection by the municipal authorities of Nice.

Pritchetts & Gold, Ltd.

The bulk of Messrs. Pritchetts & Gold's exhibit consisted of their standard cells in glass boxes, erected as in actual practice on pitch-pine stands. The positive plates are of the Planté type, with

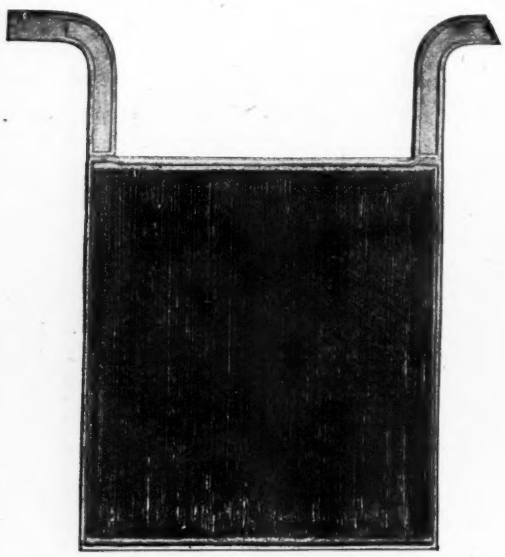


Fig. 123.—"Climax" Positive Plate.

pasted negatives, and all the plates are suspended from the edges of the boxes, with ample space between and below them. We are informed that efficiencies of 95 per cent. (ampere-hour) and 80 per cent. (watt-hour) have been obtained with these cells.

The chief novelty exhibited was the new "Climax" positive plate, which possesses an enormous active surface. The "Climax" plates are cast as solid slabs, and are then passed through a patent machine

Fig. 124.—Pritchett Train-Lighting Cell.

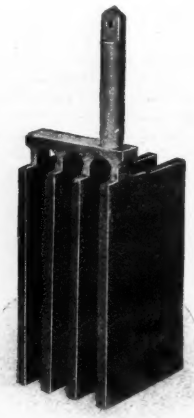


Fig. 125.—Positive Section.

which produces a great number of fine vertical laminæ on the surface of the plate. A thick solid core runs through the plate, giving it great mechanical strength and high conductance. As the result of the mode of construction of the plate, it is claimed that its capacity at high discharge rates is 30 per cent. or 40 per cent. greater than that of any other type of Planté positive, weight for weight.

A cell specially designed for the electric lighting of trains, which has progressed so rapidly in recent years, was shown; the conditions of service obtaining in this connection are very severe, necessitating exceptionally strong construction of plates and cells. We illustrate the type evolved for the purpose by Messrs. Pritchetts & Gold; similar batteries of their make have been employed by numerous British and foreign railways with satisfactory results.

A standard yacht lighting cell, in teak lead-lined box, and various accessories, including the firm's patent incorrodible connecting bolts, &c., were also exhibited.

The Switchgear Co., Ltd. (late J. G. Statter & Co.).

Of this firm's exhibit of switchgear much might be said, did space permit. It included lighting and traction generator panels, an automatic battery regulator, circuit breakers, field switches and fuses, &c., all bearing the impress of accurate workmanship.

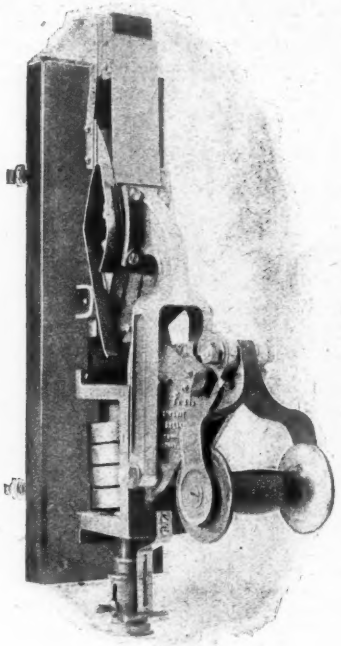


Fig. 126.—Statter Circuit Breaker, Closed.

The firm's circuit breakers were a prominent feature on the stand, and were referred to recently in connection with our description of the exhibits at the Tramways Exhibition. They are made for both maximum, no load and reverse current release.

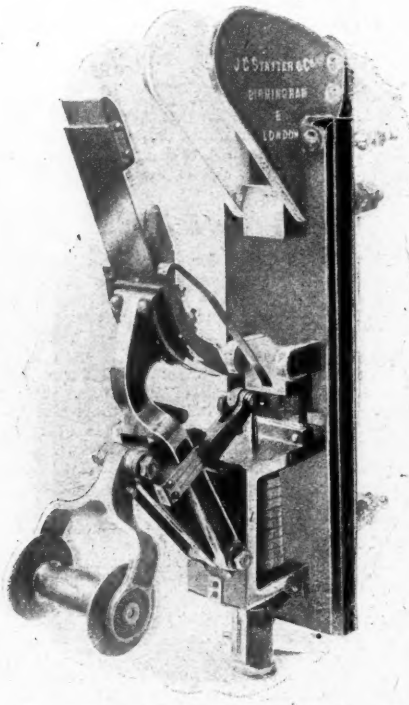


Fig. 127.—Statter Circuit Breaker, Open.

The method of leverage employed to force the brush on to its contacts, is by means of steel wheel running up an adjustable inclined plane. The long wiper seen in our illustration connects the carbon break with the lower contact; a 500-amp. breaker has proved quite equal to a 3,000-amp. load (at 500 volts) when tested with the time limit attachment. The reverse current attachment is an exceeding simple device, and the "time limit" was particularised in our issue of September 8th last.

The Amalgamated Dry Batteries, Ltd.

This firm showed many varieties of cells of their "Reeplen" and other types, all of which are manufactured at their works in London.

The Reeplen cell is much in demand for motor-car ignition work, it being used as a stand-by in the event of accumulators running down, when it is capable of supplying a large current for a considerable run.

The most interesting thing which the company were showing was the new glass jar for Leclanché cells (fig. 128). This is provided with a special "pocket" for holding the zinc rod, which effectually overcomes all difficulties hitherto experienced in the way of local action

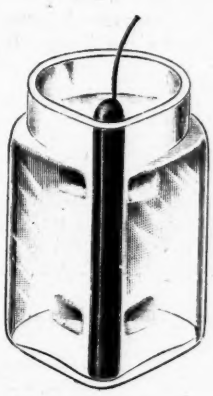


Fig. 128.—New Jar for Leclanche Cells.

and short-circuits. The jar is moulded with four "clips" after the fashion of those provided in mineral water bottles for receiving the ball, and entirely does away with rubber rings and other "fakes." The jar, which is patented at home and abroad, has already achieved considerable popularity.

Many types of small accumulators, specially designed for motor cycle and motor-car work in connection with sparking coils, were also on view.

Marconi's Wireless Telegraph Co., Ltd.

In the gallery, close by the exhibit of the General Post Office, was the interesting stand of this company and the Marconi International Marine Communication Co., Ltd. The former company showed a variety of instruments manufactured at the works at Chelmsford, the Fleming cymometer or wave measurer, already described in the Electrical Review, being in evidence. By the way, we learn that though this instrument has only been on the market a few weeks, a number have been already supplied to the British, Italian, and American Governments. A complete installation of X-ray apparatus, telegraph instruments, ignition coils and so on were likewise shown. The Marine Co.'s exhibit was particularly interesting, because it was a representation of a Marconi wireless telegraph cabin and installation as employed on board a Cunard Atlantic liner.

(To be continued.)

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"E. W." writes:—"In the issue of the Review for September 8th on p. 381, occurred a short paragraph under the heading 'Seaton,' in which the statement was made that 'any member' of an urban district council 'holding an interest in a gas company, would be debarred from speaking or voting on the subject' of the application of a private firm (or company?) for consent to taking out provisional electric lighting powers.

"If this statement is accurate, and I understand it correctly, I shall be glad to know from you the number of the 'clause in the Local Government Act' referred to, in the usual manner (as I understood from your representative at Olympia that you would be good enough to state a reply) in the Review. I believe that in any case, a town councillor holding shares in a gas company is debarred from voting on the purchase of that undertaking by the council, as is the case in Pontefract at the present moment, but I cannot find any precedent similar to what appears to have taken place at Seaton."

*** It is provided by the Municipal Corporations Act, 1882, Sec. 12 (1) that a person shall be disqualified for being elected and for being a councillor if and while he . . . . (*c*) has directly, or indirectly, by himself or his partner, any share or interest in any contract or employment with, by, or on behalf of the council; (2) But a person shall not be so disqualified, or be deemed to have any share or interest in such a contract or employment, by reason only of his having any share or interest in . . . . (*d*) any company which contracts with the Council for lighting or supplying with water or insuring against fire any part of a borough. Note that the foregoing provisions strike at the total disqualification of interested persons. The Act, however, goes further, and although interest in a gas company may not disqualify for candidature it does prevent a person speaking or voting. Thus by Sec. 22 (3) a member of the Council shall not vote or take part in the discussion of any matter before the Council, or a Committee, in which he has, directly or indirectly, by himself or by his partner, any pecuniary interest. In the Seaton case it would seem that those interested in the supply of gas would have an indirect pecuniary interest in an application by a company for consent to making application for a provisional order for the supply of electric light.

"Motorist" writes:—"It is intended to put down an electric plant for supplying an Urban District with light. The Council, which owns gasworks (the only lighting supply at present) will not venture same, but is waiting for a large concern nearly 30 miles distant to bring a supply to its district. Can the Council prevent me from entering on this scheme? And if not, must I have Parliamentary powers before doing so? Gas is very expensive, and by putting down a water turbine I could supply electricity very much cheaper than gas."

*** There is nothing to prevent "Motorist" from undertaking the supply of electricity in the manner suggested. It is not necessary for anyone to obtain Parliamentary powers for the supply of electricity. The only way in which the District Council may hamper the scheme is by prohibiting the placing of electric cables either under or over the roads which may be under their care as highway authority. It is possible, however, that the plans of the scheme may be so laid that it will be unnecessary to cross any highway. While, as has already been stated, no Parliamentary powers are required, it will be necessary for "Motorist" to comply with certain regulations made by the Board of Trade with a view to securing the safety of the public. These regulations are entitled "Regulations prescribed by the Board of Trade under Sec. 4 of the Electric Lighting Act, 1888." They may be obtained from Messrs. Eyre & Spottiswoode, London, E.C.

"Doubtful" writes:—"I am the tenant of a field, which I let for fêtes, &c., and wish to light it with the electric light, by means of overhead wires carried on scaffold poles. My electrical adviser informs me that bare copper wire mains will be many times cheaper and just as efficient as covered wires, but he is doubtful on the following points:—

"1. Is it legal to use bare conductors on private property for 200 volts alternating?

"2. Can the Corporation electrical engineer refuse to connect, provided the leakage is below the $\frac{1}{1000}$th part, as provided by the Board of Trade?

"3. The N.T. Co. and the G.P.O. both have telephone wires crossing above the proposed route of lighting wires. Can they make me put up guard wires or insulated spans under their wires? or, as it is on private property, must they protect their own wires?

"I believe the G.P.O. and N.T. Co. both have agreements with the landlord of the property."

*** "Doubtful" does not make it quite clear whether he intends to generate his own electricity, or take a supply from the corporation of his district. It is presumed, however, that, having regard to his second query, he intends to take his supply from the Corporation.

With regard to (1), it is thought that, having regard to the Board of Trade Regulations, made under the Electric Lighting Acts, 1882 and 1888, uninsulated aerial lines may be used upon the premises in question. As to (2) it is provided by the regulations above alluded to, Sec. 41, that "The undertakers shall not connect the wires and fittings on a consumer's premises with their mains unless they are reasonably satisfied that the connection would not cause a leakage from those wires and fittings exceeding one ten-thousandth part of the maximum supply current to the premises; and where the undertakers decline to make such connection they shall serve upon the consumer a notice stating their reasons for so declining." The proper figure is "$\frac{1}{10000}$" not "$\frac{1}{1000}$," as mentioned by our correspondent. Subject to this clause, there is nothing which can enable a corporation to refuse to grant a supply.

As to (3) the property of the N.T. Co. and the G.P.O., this would seem to be protected by Sec 22 of the regulations (and also by Sec. 25 of the regulations made by the Board of Trade under Sec. 4 of the Electric Lighting Act, which may possibly apply to the system installed by "Doubtful") that "where an aerial line crosses, or is in proximity to, any metallic substance, precaution shall be taken by the undertakers against the possibility of the line coming into contact with the metallic substance, or of the metallic substance coming into contact with the line by breakage or otherwise."

Great Western and Metropolitan Contract.—With reference to this contract mentioned in our last issue, we understand that the equipment of the 20 trains referred to will consist of the B.T.-H. type G.E. 76 motor and the Sprague Thomson-Houston system of control.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession

The Electro-Deposition of Copper.

I am greatly surprised that Mr. Cowper-Coles should deem me guilty of endeavouring to mislead your readers, for had I referred to tubes produced by any process other than the Elmore burnishing process, the value of my disclaimer would have been *nil*.

Harry Ellis,
Managing Director,
Elmore's Metall Actiengesellschaft.

London, E.C.,
October 19th, 1905.

The Design of Instruments and Meters.

My attention has just been called to "O.K.'s" attack upon the Inkless Recorder. He also attacks the electric clock used for propelling it, for which I am responsible, and does so in a peculiarly ignorant manner. If he knew anything of the application of electricity to time-keeping, or had even looked intelligently at the instrument he was criticising, he would see that the method used to obtain the periodic impulses is as far as the poles apart from "grandfather clock arrangements and relay contacts." No one has condemned "those relay contacts" in connection with clockwork in press or on platform more vigorously than myself. The automatic pendulum switch used by Messrs. Everett, Edgcumbe & Co., Ltd., contains those essential principles which have made electrical time service a success in this country, viz., the transmission of all the energy through the surfaces of the contact and the use of the self-induction of the circuit to determine the duration of the impulse.

F. Hope-Jones,
For the Synchronome Co.

London, E.C., *October 22nd*, 1905.

Municipal Wiring.

In your "Lighting and Power Notes" in the current issue of the Electrical Review, I notice that the Town Council of Huddersfield are seeking powers for the wiring of houses for lighting purposes.

I, for one, shall be pleased to learn the details *re* the above, as soon as the various clauses are framed.

It is to be hoped the Town Council do not propose to carry on a wiring business in competition with the local contractors similar to the proposals recently made by the L.C.C. The writer is acquainted with a town where, at the request of a would-be consumer, the Corporation will pay for the cost of installing the wiring in houses, on condition that the consumer guarantees taking a supply for a given length of time, and undertakes to pay interest on the total cost of the installation, and instalments to pay back the total capital cost, such instalments to cover the period given in the guarantee.

In every case where the Corporation undertake this wiring work, it is let out to one or another of the local contractors, who are asked to tender for the same.

In cases similar to the above it brings consumers to the supply mains and puts work in the contractors' hands, and is beneficial to all parties concerned.

If the Huddersfield Town Council are seeking powers to carry out wiring on terms similar to the foregoing, I hope the same will be speedily granted.

H. Moss.

Huddersfield, *October 23rd*, 1905.

[Where the work is placed in the hands of contractors there is no material objection to the practice, as the Corporation is not then competing with its own ratepayers. This, however, is not "Municipal Wiring"—*i.e.*, wiring carried out by the Corporation's staff, to which we strongly object.—Eds. E.R.]

Bonding Steel Armour.

In a combined system of traction and lighting, is it necessary to have the steel armour of the three-core lighting mains bonded across where joint boxes are fixed? Of course, the lead covering of all distributors and service cables is bonded across. The writer has heard that there is a danger of electrolysis if the steel armour of cables is not attended to in the same way, and he would like enlightenment on the question.

R. W.

New Feeder Pillar.

In your issue of 20th inst., in describing the above pillar, you state that it is Downe's patent; this is not correct, as the idea was worked out jointly by my assistant, Mr. A. S. Black, and myself, the patent being taken out in both our names.

I shall be obliged if you will make this correction in your next issue.

R. S. Downe,
Borough Electrical Engineer.

Southport, *October 21st*, 1905.

Lead-Covered Wire.

With further reference to our letter on the above subject in last week's Review, our attention has been called to the fact that we were writing of rubber-insulated wire, whilst possibly Mr. Whipple referred to paper-insulated wire. In this case, of course, our experience could not be taken as anything for Mr. Whipple to work upon.

We have had practically no experience with paper-insulated wire, but we should think there would be considerable risk of its being hygroscopic, even if the paper were impregnated with compound or similar material.

We trust that you will have further information on the subject put before you, as we should like to hear of other people's experiences with wire of this description.

Tyler & Freeman.

London, E.C., *October 24th*, 1905.

We have read with much interest the letters of Mr. Whipple and Messrs. Tyler and Freeman regarding lead-covered wiring. We should be interested to hear, however, whether these gentlemen are referring to vulcanised rubber-covered wires, or the paper-insulated class. Our experience has been almost entirely with the latter, and, like your correspondents, we have found it very satisfactory; in fact, we only use vulcanised wire on installations where it is specified.

Of course, this class of material is distinctly hygroscopic, and it is essential that the ends should be kept sealed. This, and the absolute necessity of bonding and earthing the lead, constitute the only drawbacks to its use.

We have found in practice that for house wiring the single wire is much more economical than twin, as it can be so readily brought down to switches, but twin is more satisfactory for positions where the circuits consist of one row of lights coming straight from the distribution board without intervening switches. Of course twin wire looks much nicer, and is more easily erected than two single wires.

The two objections usually urged against this class of work are, first, the danger of nails, &c., being driven into the lead, and, secondly, that the appearance of it is not so substantial as that of casing and capping.

Bearing in mind the advantages of a properly carried out system with bonded and earthed lead sheaths, these are not really serious defects; such as they are, we overcome them in the following manner:—

In house work the wiring is run between floor and ceiling without other protection than the lead; in passing, we may remark that a much smaller groove is necessary than with other systems. If the house is new and not plastered, we run the wires in a $\frac{5}{8}$ open seam tube down the walls to switches, distribution boards, &c., or if the walls are already plastered the wires can be run in casing and capping wherever the run is on the surface, the size of the casing required being no larger than with ordinary vulcanised wire.

Apart from the advantage of having your conductors surrounded by an essentially continuous earthed metallic sheath, it must not be forgotten that, properly installed, paper insulation does not depreciate like vulcanised rubber. What will probably appeal to the contractor, however, is the economy of the system, as this class of wire is actually cheaper than ordinary wire, apart from the saving of time and casing.

Of course, like everything else it requires a little experience, but we are sure that if contractors would only persist in its use for, say, half-a-dozen jobs, they would soon appreciate the substantial savings obtained.

The principal point is the sealing of the ends; rubber tape should on no account be used, as the oil in the insulation soon rots the rubber. For small jobs we have found a specially prepared black tape having high insulating qualities satisfactory, but we have, generally speaking, found it worth our while to use a small iron casting which serves the triple purpose of bonding the lead, sealing the insulation and holding the switch and ceiling rose without materially raising the cost of the installation.

We trust these remarks may be of some service to those who may not have used this very excellent system, and we should like to hear the opinions of those who have.

If any firm are thinking of trying it and they care to write to us, we should be glad to put them on the right track as to the material to make a start with.

H. Bailey & Co.

Accrington, *October 24th*, 1905.

Watertight Wiring.

It has been brought to our notice that a circular which we issued at the recent Electrical Exhibition at Olympia may lead to the misapprehension that Messrs. Handcock & Dykes, consulting engineers, have some interest in the watertight tube system of wiring which we have been exhibiting there.

We therefore wish to explain that, some time ago, we tendered successfully to a specification of Messrs. Handcock and Dykes, which called for the use of this system, which they had devised and used for some years past to meet certain difficulties in wiring work.

Since then we have carried out similar installations under the direction of the same firm, and found the system to possess so many advantages that we proceeded to stock the necessary parts.

We have modified the boxes in one or two directions, and in other ways altered the system to suit our own purposes.

Our only object in mentioning Messrs. Handcock & Dykes's name was to make it clear that the credit for the invention was theirs, but we wish to make it equally clear that they have not patented the system, and have no financial interest in it.

Rawlings Bros., Ltd.

London, S.W., *October 24th*, 1905.

Hygienic Telephones.

The General Electric Co. evidently consider they have, so to speak, "got us on toast," hence their condescension in granting us the favour of a free advertisement. Talking about that, we can only remember one subject brought by us to the notice of the Press about which the G.E.C. remained silent—viz., our challenge: offer of a committee of experts, and £100 to charity. We own we were much disappointed that they, as one of the representative British firms of telephone manufacturers, did not grant us the privilege of further advertising ourselves by accepting the challenge.

Now for a free advertisement for the General Electric Co., without any favour or thanks required. We have referred to their catalogue of 1899, and find that it certainly did contain a hygienic wall telephone of sorts. In case your readers have no longer a copy to refer to, we take this opportunity of illustrating, with apologies to the General Electric Co., an outline drawing of the instrument.

Without any desire to detract from the merits claimed for it, we would point out that it was not a hand combination set, and, although styled "hygienic," the instrument was not by its construction naturally a hygienic telephone, since the pine-wood diaphragm against which it was necessary to speak had to be periodically wiped with a duster. Instruments of not dissimilar construction were in use nearly 20 years ago, and the writer well remembers fixing a pair at about that time. True, they were not called hygienic, but if the G.E.C. telephone possessed such merits, then these and others on the market prior to 1899 anticipated such claim.

While we admit we were in error in stating in our letter of the 18th inst., that we were the first firm to offer a hygienic telephone to the British public, inasmuch

as we were obviously dealing with the subject of *hand combination sets*, we feel we may be excused for not more carefully qualifying our statement, and for having overlooked what, after all, appears to be an obsolete pattern, and far removed from the class of telephone under discussion.

In conclusion, we consider that our letter of the 10th inst. was, in the main, correct, and, notwithstanding the General Electric Co.'s reply, they have not justified their attempt to "steal a march" upon us with their solitary pair of hygienic hand combinations.

pp. **The Sterling Telephone and Electric Co.,**
Late the Berliner Telephone Manufacturing Co.
I. B. Birnbaum, *Manager.*

London, E.C., *October 24th*, 1905.

Invidious Comparisons.

A certain station engineer recently read a paper dealing with the cheap supply of energy, before a small local society. As evidently it did not meet with sufficient publicity, he has now had it reprinted, sending copies to various authorities whose undertakings, according to himself, are not doing as well as his own. A table appears in the paper giving a list of various undertakings, comparing their costs with his own and showing the saving which would have been effected if their costs had been as low as his own. I notice, however, that although he apparently takes his own "works costs," he takes the "total costs" of the other undertakings, unless the figure he gives for his own undertaking refers to the last year, not yet published, in which case he is comparing it with earlier years of the other undertakings. I consider this paper in the hands of some councillors would be apt to

cause a very wrong impression, with consequent further trouble for the already harassed engineer, as the author states that what he has done, can be done elsewhere, taking no account of the great differences in various localities. The whole tone of the paper is self-congratulatory, and it appears to me to have been written for the purpose of advertisement, as there is nothing new in it.

Another Pebble.

The New Guernsey Telephone Switchboard.

The brief description of this interesting installation on p. 659 of the REVIEW omits several interesting points. The daily traffic of 900 Guernsey subscribers is about 1,800 calls ; allowing for extra work on junction calls, in and out, and public station calls, and for the recording of calls, such a volume of traffic might provide a moderate day's work for three or four operators. By using mechanically restored indicators—which occupy much space and prevent team work—by placing the cords on two levels, and by other eccentricities, a switchboard has been evolved which is about three times longer than is necessary and employs more than three times as many operators as are necessary to do the work.

The hearty admiration of all telephone men must be aroused by that notable adaptation from modern telephone practice, the "double-sided ring-off." The "double-sided ring-offs," it appears from the circuit diagram, are to be worked by push-buttons on the subscribers' instruments, and as the operators must not "sever a connection" until both "ring-offs" have "put in an appearance," both subscribers must always remember to press the button, or else remain "hung up." This is a great improvement on the ordinary push-button or magneto system, where either subscriber can ring off, as it increases the chances of "hang-ups" by just 100 per cent.

If modern telephone practice had really been followed at Guernsey, and an attempt made to design a switchboard having some relation to the load to be carried, a lamp-signal board, to be served by a third of the number of operators, would have been adopted. But even a bridging magneto-board would be more efficient and more economical than the outfit described.

Herbert Laws Webb.

London, S.W.,
October 21st, 1905.

Some Arithmetical Questions for Mr. Byng.

Perhaps "Jaybee" has not heard of the N.E.M.A. I am sure that body would be able to do all that he suggests, as it does not appear to be backward in regard to publicity.

With regard to the other matter, I cordially agree with "Jaybee" on the desirability of protecting British industries. There was no sentiment to the contrary in my letter. The moral that I wished to point (and which "Jaybee" conveniently ignores) was that, if it is at the present moment unfortunately necessary to import certain things from abroad, let us "play the game" in the correct British fashion.

Anti-Humbug.

I do not propose to enter into the wordy war now raging, except to mention an incident which I think is worth columns of argument. A year or so ago I met a gentleman who imports large quantities of foreign-made dynamos and motors. In conversation he mentioned that his directors were about to erect large works near London for supplying the British market. A few months after, meeting my friend again, I inquired when the works were to be started. Listen to his reply. "My directors have come to the conclusion that Mr. Chamberlain's policy will not be adopted, and have, therefore, abandoned the idea of the English works." Had the many intelligent foreign manufacturers who have been carefully watching the recent by-elections, been able to come to the conclusion that Mr. Chamberlain's proposals would soon be adopted, we should already see many new industries rising in our midst, adding to the prosperity of the country and giving employment to thousands now out of work.

T. R.

I have read the letter of Mr. "Jaybee not a fooled Englishman" in the ELECTRICAL REVIEW of the 20th inst., and in summing up the whole article I find that though much is written there is nothing in it, simply empty phrases, and much talk and no do.

I, myself, am a foreigner, and have seen many countries, and come to the conclusion that the writer of the article in question knows nothing of any other country but England, and admits his ignorance and non-efficiency, and might be compared to a wreck on an open sea at its last resource.

It is very good to stand up for one's own country, but no protection will avail so long as no remedy is found for the better education of the workmen, that means cheap and sound education for everybody, not only for the Upper Ten, for whom alone scientific knowledge is open in this country.

Your remarks about the London County Council having passed over the Hungarian Works Estimate of £38,200 and accepting a British tender for £63,525, shows quite sufficiently that narrow mindedness combined with political matters is brought into the question of economy, which does not say much for a County Council.

In my opinion, it is wrong to place an order with British manufacturers whose estimate is 100 per cent. higher than foreign manufacturers. The extra expense must, of course, come out of the pockets of the ratepayers, and no good at all is effected by this for the unemployed, and in comparing the two tenders, it is shown that the same amount of work can be done with the same efficiency at a much lower rate.

I have a good knowledge of the labour question in other countries, and "Jaybee's" remark, that no law exists, shows that he is not well enough instructed in this matter. I would point out that the skilful labourer abroad ranks much higher, and lives more respectably and comfortably, than the labourer here, who is only considered "the workman." Abroad, the workmen, even with their small income, can bring theie children up with a good sound education, so as to enabls them to fight the world and make their own way. Besider this, they can also save for a rainy day, so that, should their country or town prove too small for them, they can emigrate, instead of staying in one district as the British workmen do, possibly to starve, and cry to the public for help, which, in my opinion, only encourages laziness.

For your further instruction, I would say that abroad the skilful workman has better protection owing to the Government and other institutions, than in this country, where everything has to be obtained by heavy expense and sacrifice.

No protection or any other law will be able to keep out competition, but will only make it keener, if the question of education is not considered ; that means cheap schools and apprenticeship after schools, as abroad, where with only a few pounds even a not very wealthy man can educate his son to matriculation for a University.

Further, the pride of an English gentleman prevents him from allowing his son to get practical experience by working in workshops, &c., which is the only way to get a practical knowledge and experience of the trade he would learn.

In these points the root of all the evil lies, and no success can be expected before steps are taken to eradicate the evil.

The best weapon a country can have is a good army of skilled workmen, which is really the foundation of a nation.

A Foreigner.

[Our correspondents incorrectly state the amounts of the above tenders, which should be £58,200 and £63,525 respectively ; this is an increase of only 9 per cent. on the amount of the foreign tender, which, moreover, did not comply with the specification.—EDS. E.R.]

[NAME WANTED.—A correspondent wants to know the name of a firm supplying hand travelling cranes suitable for wheeling armatures about.—EDS. E.R.]

Electric Furnace at Olympia.—MESSRS. MARRYAT AND PLACE have been instructed to supply to the University of Glasgow a duplicate of the 1,000-ampere Moissan furnace they have been showing in operation at Olympia. During the last week of the Exhibition, the diamonds obtained from carbon dissolved in iron were on view. The microscopic output consisted of about 50 diamonds, which were mounted upon one slide. Enlarged 40 times, the crystals could be clearly seen.

MILAN INTERNATIONAL EXHIBITION, 1906.

Mr. Arthur Serena, the hon. Executive Commissioner in connection with this Exhibition, writes to us urging the importance of ensuring that a representative show of the varied products of British electrical industries, worthy of their growing manufacturing importance and international standing, may be made thereat.

As our readers are aware, the British Government has shown a practical interest in the Exhibition by a grant of £10,000 towards the cost of forming a British Section, and has approved the appointment of a British Commission, with Mr. Serena as hon. Executive Commissioner.

He says that the participation of leading firms in all the general lines of British manufacture is assured, which makes it all the more imperative that the electrical industries should be adequately represented. The King of Italy has given £4,000 in prizes to be awarded by the International Jury in the various sections of the Exhibition, of which a prize of £200 is to be given for the best method of detecting high voltage currents without danger to the operator.

The comprehensive character of the electrical divisions of the Exhibition will be gathered from the details given below in the Section for Land Transportation (electric traction) Telegraphs and Telephones, and that of Manufacturing and Decorative Arts (lighting and heating). The inducements to exhibit are stated to be as great as the Italian authorities are able to make them, and the greatest of all inducements will be the fact that the present is the first international exhibition ever held in Italy.

Section 1.—Land Transportation, Division VI. (Electric Traction).

The programme for this section is sub-divided into five groups and 19 classes as follows:—

Group 33.—*Generating Plant.*
- Class 50.—Plans, drawings, models of hydraulic steam and gas installations, and of central stations for electric traction.
- Class 51.—Dynamos, alternators and transformers for traction purposes.
- Class 52.—Stationary accumulators of the traction type.

Group 34.—*Electric Railways and Tramways.*
- Class 53.—Poles, supports, insulators, systems of suspension, attachment of wires, &c.
- Class 54.—Overhead lines for long-distance transmission and service lines, third rail, conductors and insulators.
- Class 55.—Electric railway track, systems of bonding, switches, special types of permanent way for the conduit and surface contact systems.
- Class 56.—Fittings for electric lines, signalling apparatus, special telegraphs and telephones for electric railways and tramways, special steering apparatus and safety appliances, lightning arresters, &c.

Group 35.—*Rolling Stock.*
- Class 57.—Special motors for electric traction.
- Class 58.—Special parts of carriages for electric traction, carriages, fittings for motormen's cabins, controllers fittings for taking up current.
- Class 59.—Complete motor-cars for tramway service; trailers.
- Class 60.—Complete motor-cars for electric traction on large railway lines, electric locomotives, trailers.
- Class 61.—Motor trolley vehicles on ordinary roads.
- Class 62.—Electric accumulators for traction purposes.
- Class 63.—Accessory services on cars, lighting, heating, &c.

Group 36.—*Various Applications of Electric Traction.*
- Class 64.—Ropeways, aerial transportation.
- Class 65.—Electric cranes, capstans, lifts.
- Class 66.—Special electric plant for mines.

Group 37.—*Documents.*
- Class 67.—Plans, designs and models in general.
- Class 68.—Statistical information on the construction and running of electric tramways and railways; details regarding cost and profits resulting therefrom.

Division IX.—Post, Telegraphs, Telephones.

Group 48.—*Projects.*
- Class 98.—Designs, models, photographs of buildings for postal, telegraph and telephone service, organisation and regulations, charges.

Group 50.—*Telegraphs and Apparatus.*—Wireless telegraphy (included in maritime transportation).
- Class 100.—Supports, insulators, wires, crossings, erecting, laying down telegraphic apparatus, controlling and measuring instruments, appliances for telegraphing.

Group 51.—*Wireless Telegraphy and Marconi's Apparatus.*
- Class 101.

Group 52.—*Telephonic Lines and Apparatus.*
- Class 102.—Supports, insulators, wire cables, crossings, underground lines, telephones, microphones, standard and multiple switchboards, controlling apparatus, appliances for telephoning, phonographs and similar instruments.

Section 4.—*Manufacturing and Decorative Arts.*

Group 80.—*Art Objects* and industrial products belonging to the æsthetic side of modern life in all its shapes.
- Class 203.—Lighting and heating apparatus, electric appliances, fittings and adjuncts for light in all its branches.

Royal Prize for Apparatus for Detecting Electric Currents of High Potential.

The Executive Committee, with the object of encouraging the study and the practical testing of a simple appliance, easy to handle and of small cost, which shall serve to detect the existence of currents of high potential in electrical cables which have to be handled by workmen charged with the laying or repair of such cables, offers an international prize of £200, having for this purpose allotted a portion of the sum given by His Majesty the King of Italy for competition in the Exhibition.

The competition will take place under regulations which stipulate that all competitors shall present their applications before December 31st, 1905.

The chief technical conditions which the appliance has to satisfy are the following:—

(*a*) Must be easy to handle, conveniently portable, and not exceeding 7 lb. (3 kgo.) in weight.

(*b*) Must reliably reveal clearly and safely differences of potential of not less than 300 volts.

(*c*) Must not require special conditions of application, and must give indications easily readable and of a nature to avoid all uncertainty.

(*d*) The cost of the appliance must be low; other things being equal, the most economical will be preferred. It must be easy of repair and so constructed that the breakdowns in working to which it may be subject as a whole or in any part shall be easily detected and noticed, and such as not to give rise to any dangerous uncertainty.

(*e*) Shall not be liable easily to get out of order or out of repair even when subjected to very great differences of potential, or through atmospheric influences, shocks, abnormal position, &c.

(*f*) The method of mounting the parts subjected to wear and fear and exchange, shall be such as to disclose in some clear fashion any getting out of order which may be dangerous.

Clause 5.—The jury for the allotment of the prize shall be composed of five members, two of whom shall be appointed by the Executive Committee of the Exhibition, two by the Italian Electrotechnic Association, and the fifth by the first four.

BUSINESS NOTES.

Patents in Turkey.—Messrs. W. P. Thompson & Co., patent agents, Liverpool, write:—

As is probably well known, the Sultan frequently, in an arbitrary manner changes the procedure and regulations as regards patents. Some months ago he decided that all the annual taxes on patents or trade marks were to be doubled, and that this should apply to patents and trade marks already registered. Our agent in Constantinople at once went to all the principal Embassies and laid the matter before them, and we have learned from him to-day that at the instance of the Ambassadors, the Sultan has withdrawn his Irade as far as regards all patents and trade marks actually on the register, while continuing the Irade in force for all new matters. It will be remembered that some years ago the Sultan gave orders that all patents in any way relating to electricity should be refused as contrary to law and order. In a similar way at one time patents for photography were refused because the Mohammedan law forbids in the most emphatic manner "the making of a likeness of any thing that is in the heavens above, or in the earth beneath, or in the waters under the earth." Both these restrictions have, however, been greatly relaxed.

Contracts for Large Gas Engines.—The following orders for large power gas engines have recently been received by Messrs. J. E. H. Andrew & Co., Ltd., of Reddish:—

Messrs. Brooks & Doxey, Ltd., Union Iron Works, West Gorton, Manchester. Six engines, each of 120 B.H.P., together with a Mond gas producing plant, for driving their own works.

The Coalbrookdale Co., Ltd., Coalbrookdale. Two double-cylinder type engines, each of 210 B.H.P., for driving alternators for their own works.

Messrs. J. Mowlem & Co., London (for the Thames Ditton and Esher U.D.C. Pumping Station). Three engines and suction gas plants, each of 50 B.H.P.

The Manchester Corporation, for its Sewerage Works at Withington. One engine and suction gas plant of 90 B.H.P.

Messrs. Ogston & Tennant, Ltd., Loch Street, Aberdeen. Two engines and one suction gas plant of 140 B.H.P.

Messrs. A. Muirhead & Sons, Glasgow. Two engines and suction gas plants of 120 B.H.P.

Messrs. Cox & Co., engineers and shipbuilders, Falmouth. One engine and suction gas plant, of 120 B.H.P.

Messrs. Hosken, Trevithick, Polkinhorn & Co., Ltd., Hayle, Cornwall. One engine and suction gas plant, of 60 B.H.P.

The Co-operative Wholesale Society, Ltd., Soap and Candle Works, Irlam, near Manchester. One double-cylinder engine of 280 B.H.P. This is the second large Andrew's engine to be supplied for these works.

The company is at present extremely busy in all departments with engines and gas producing plants, necessitating the working of overtime continually.

Moser v. Scott.—In the Westminster County Court on Monday last week, this case was disposed of. It was a claim for damages for trespass sustained through the cutting off of an electricity supply at 50, Maddox Street, W. The case had been part heard. James Henry Scott, on behalf of plaintiff, said he was a builder and electrician, and in May received an order for electrical work from Mrs. Farquhar, who told him that the upper part of the house was vacant, and the landlord had given her permission to use any of the wiring already there for her electric lighting. She had the first floor and wanted lights by the windows in connection with chairs she had for use in her manicure business. He did not cut off the wires downstairs. He did not go on to the premises downstairs. An electrician in defendant's employ, who did the work, said he found some fittings there, but there had been a disconnection as the meter had been taken away. He was in court at the previous hearing, and heard the evidence that the wire was cut on the ground floor. Witness heard instructions from Mrs. Farquhar to Mr. Scott that he was to use the existing fittings. He disconnected the upper part of the house. The whole of the premises had one pair of mains, and Mrs. Farquhar wanted a separate meter, and it was necessary to disconnect the other part. The employer was told to do certain work

by Mrs. Farquhar, and if anyone was liable, it was her. Counsel for the plaintiff: I submit the person who commits the trespass is liable, and in this case he would have a remedy against Mrs. Farquhar. The Judge: No, her instructions were carried out. Counsel: Do you say no trespass was committed? The Judge: I do not say so. It is not necessary. Counsel: We have a supply of electricity, and the wires were cut wilfully, and that is an act of trespass for which the employer, who authorised the actual trespass, is liable. The Judge: It turns on the instructions given him. I must non-suit you with costs, and give you leave to bring another action.

For Sale.—Colchester Electricity Committee invites offers for the disposal of 70 maximum-demand indicators. See our advertisement pages to-day.

Bankruptcy Proceedings.—G. Wallace.—On Thursday last week, at the London Bankruptcy Court, Mr. E. S. Gray, Official Receiver, presided at the first meeting of the creditors of George Wallace, electrical engineer, 132, Cold Harbour Lane, Camberwell. The accounts show unsecured debts £330 5s. 6d., preferential claims £30 0s. 6d., and assets £755 13s. 10d., representing assets £750, the debtor's half-share in an option for the sale of a primary battery. It appeared from the debtor's statement that he returned from Australia in 1897, and during the next six years carried on business in Dublin. In 1903 he opened an office at 68, Victoria Street, S.W., and there carried on business in electric lamps under the style of Wallace & Co. That concern was in April, 1904, converted into the Wallace Lamp Syndicate, Ltd., with a capital of £35,000. As vendor the debtor received £10,000 in shares, and was appointed as salaried manager at £350 a year. The company is still carrying on business, but dismissed him last April for alleged non-performance of his agreement with them to manufacture the Wallace lamp under a secret process. In reply to the Chairman, the debtor said the only offer he could make to the creditors was for them to deal with the application. It had no present value, perhaps, but might bring into the estate £750 in time. The case was left in the hands of the Official Receiver to be wound up in bankruptcy, the debtor's public examination being fixed for November 14th.

Wm. Jefferson.—At Stockton-on-Tees Bankruptcy Court on October 18th, Wm. Jefferson, carrying on business under the style of Jefferson & Co., electrical engineers, at Skinnergate, Darlington, and Kingsley Chambers, Bishop Auckland, was examined, on accounts showing liabilities amounting to £254 and a deficiency of £211. Debtor attributes his failure to "bad trade, partnership creditors pressing him, and bad debts in connection with the partnership." Debtor stated that he commenced business in partnership with Chas. Muse Wilson, who is now in Canada, in 1899. Each put £250 into the business, and after a year's trading Wm. Flint, who contributed £200 or £250 to the business, was taken into partnership. At Mr. Flint's death in 1902, his son took up his father's share, and also bought out Mr. Wilson for about £79. Mr. Flint then put a further £600 into the business, and the partnership was dissolved in October, 1904, Mr. Flint taking over the whole of the assets and liabilities. An agreement to this effect, however, was never signed, Mr. Flint dying in December, 1904. Since October, 1904, debtor had carried on business alone. The examination was adjourned until November 8th.

J. S. Robson.—At Newcastle-on-Tyne Bankruptcy Court on October 19th, John Samson Robson, trading as Robson, Robson and Co., electrical engineers, of Empire Buildings, Newgate Street, Newcastle, was examined, and the examination was adjourned until November 9th.

Thomas Hill, electrical engineer, Vicarage Road, Wolverhampton.—Date of first meeting, November 7th; public examination, November 8th—both at Wolverhampton.

Catalogues and Lists.—The Electrical Co., Ltd., Charing Cross Road, London, W.C.—October Nernst price list (No. 188), with a strikingly artistic cover. This pamphlet includes all the types as shown in the firm's old list, and it explains fully the special advantages of the Nernst lamp, and compares the cost of current consumed by Nernst lamps with ordinary incandescent lamps. With the "Multiple" lamps it is pointed out that the amount of light can be regulated as required—that is, from 180 to 820 c.p. It is claimed that the multiple Nernst lamp, for which the prices have been considerably reduced, will effectively replace arc lamps where an even distribution of light is required. Some accessories are illustrated which are essential with Nernst lamp installations with the smaller (B.C.) types; some punch pliers are also shown for use in all instances on direct current circuits, so as to ensure polarity being observed. There is a small ammeter illustrated, whose purpose is to easily demonstrate the advantages of Nernst lamps over incandescent lamps in current consumption. Various watertight fittings for shop and street lighting have been added. Mention is also made of the E.C. (A.E.G.) incandescent lamps, it being pointed out that the company has the "largest factory in all Europe, with an output of 15 million lamps per annum."

Messrs. Geipel & Lange, London.—Card of prices, code words, &c., for Ward-Leonard motor-starters for motors ranging from ½ to 50 h.p.

The Wagner Electric Manufacturing Co., St. Louis, U.S.A.—Pamphlet containing illustrated description of the company's standard lighting and motor transformers, "two types in one."

Messrs. Richardsons, Westgarth & Co., Ltd. Electrical department, Hartlepool.—20 pp. pamphlet giving an illustrated description of the power house and sub-station of the Alexandria-Ramleh electric railway, as supplied by Messrs. Brown, Boveri and Co., Ltd., of Baden. There are two Tosi 750-h.p. horizontal tandem compound condensing engines driving 600-kw. three-phase alternators of the Brown-Boveri revolving field type, running at 107 r.p.m., and giving a 6,500-volt current at a frequency of 25 cycles per second. A sub-station at Bulkeley contains 110-kw. transformers and 300-kw. rotary converters. A 350-volt reduced alternating current is converted to a 560-volt continuous current. The electrification of this railway was completed in December, 1903, and the results have been "more than satisfactory," the earnings having increased by 33 per cent. in "the first months."

Messrs. John Wilson & Co., 49, Lime Street, E.C.—A well-bound and fully illustrated catalogue of iron and steel tubes and pipes with fittings and connections for various descriptions of work. In the course of 46 pages the firm's method of supplying complete piping installations for electric power stations, factories, &c., is particularised. The pipes are supplied cut to lengths with all bends and connections, having the flanges drilled ready for fitting into position on the job, thus saving boiler-makers and engineers a considerable amount of time, trouble and expense. After detailing all the various parts and prices of different sizes of same, there appears at the end of the catalogue an illustration of one of Messrs. Wilson's plants which was assembled and fitted together at the works for inspection before being shipped to India. The firm's piping specialities have been supplied to many electric power stations in this country and abroad.

The Charles Cohen Tool Co., 34, Barbican, E.C.—New catalogue of tools and materials for watch and clock makers, electricians, engineers and all light mechanical trades. Some 2,000 illustrations appear in the 240 pages. The measurements are given both in mm. and in inches, and every tool is priced.

British Thomson-Houston Co., Ltd., Rugby.—Pamphlet No. 184, just issued, giving detailed particulars and many neat illustrations of the B.T.H. arc lamps, and views of works where they are employed for interior and exterior illumination. Accessories, fittings, shades and reflectors, are also enumerated.

Messrs. Isaac Storey & Sons, Ltd., Empress Foundry, Manchester.—Illustrated pamphlet relating to the "Wollaston" patent water softener.

Messrs. J. P. Hall & Co., Blackriding Ironworks, Oldham.—New 80-pp. publication (No. 25), giving illustrations of the firm's manufactures, such as dynamos, steam engines, continuous and alternating current motors, electric winches, patent liquid starting and reversing controllers, &c., and their application for various descriptions of service. Among the numerous illustrations are those showing the application of electric driving to machine tools, cranes, pumps, shipyard machines and mining plant. The photographs also include the exciters supplied by the firm for the Stalybridge tramways station, and the electric generators installed at the generating station of the Stabhill Hospital, Glasgow.

Boardman Electrical Patents Co., Ltd., 10, Southwark Bridge Road, London, S.E.—Descriptive illustrated price list of Boardman's electric arc lamps, including the portraiture lamp with collapsible parabolic reflector. A lengthy list of studios where these are lamps are used, is given.

General Electric Co., Ltd., London.—Pamphlet just issued giving illustrated particulars of the company's electro-medical apparatus for hairdressers, chiropodists, manicurists, &c.

The Amalgamated Dry Batteries, Ltd., Devonshire Square, E.C.—New catalogue of their new patent "Reeplen" sparking battery for motor-cars, launches, &c. Illustrations and prices are given of various accumulators and coils. These, we are informed, are all manufactured in London. The works of the company are at Plough Yard, Shoreditch, and at Waltham Cross.

Messrs. Herbert Morris & Bastert, Ltd., Empress Works, Loughborough.—Illustrated pamphlet No. 41 of the H.M.B. worm-geared pulley blocks, of which some 200,000 have been sold during the last 20 years.

Messrs. Siemens Bros. & Co., Ltd., London.—Price sheet 15A (to supersede No. 15) describing the Tantalum lamp, and giving particulars as to methods of connection, economy, &c.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford.—Illustrated list No. 405 describing their gyrometers or engine "sight" speed indicators; also list No. 455 giving particulars of their "stop-rush" turnstiles, such as they have supplied, among others, to the Liverpool Overhead Railway.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.—The company are circulating a card which is an index to the chief sectional catalogues they have issued.

The Cambridge Scientific Instrument Co., Ltd., Cambridge.—A number of illustrated leaflets describing respectively: Callender's apparatus for measuring the mechanical equivalent of heat; Weicholdt's instantaneous dial micrometers; telescope and scale; the Dolezalek electrometer; Broca galvanometer; and the standard cadmium cells.

Messrs. Jarvis Bros., Ltd. (late E. F. Jarvis), Middlesbrough.—The large size of the gas and oil engines now being installed necessitates an improved method of dealing with the circulating water, and it is becoming usual for this purpose to adopt water cooling plant similar to that used to cool the water for condensing engines. We understand that this firm have received several orders for plants for this purpose, the latest being for the Cement Works of Messrs. Casebourne & Co., West Hartlepool (probably the most modern in this country), to cool the circulating water for their Diesel oil engines. They have also orders in hand for:—Messrs. J. Musgrave & Co., Ltd., Bolton, for the Bolton Corporation Electricity Works; Thos. Nuttall & Sons, Ltd., Farnworth, near

Bolton; as well as a third repeat order from Messrs. Chemical Works, late H. & E. Albert, London. Messrs. Jarvis Bros. have sent us a copy of a well-illustrated pamphlet relating to their "British" water coolers for refrigerating plants, condensing plants, gas engines, &c. Among other things the list contains particulars of plants which have been erected for electricity supply and manufacturing works in this country.

Dissolutions and Liquidations. — Delafone Batteries Syndicate, Ltd.—It was resolved on September 19th, to wind up voluntarily with Mr. E. Williams and Mr. C. B. Hahn, of Manchester, as liquidators.

Sectional Fire-Tube Boiler Syndicate, Ltd.—This company is winding up voluntarily, with Mr. W. S. Dyett, 110, Cannon Street, E.C., as liquidator.

British Electric Signs Co., Ltd.—At Dashwood House, E.C., on October 11th, it was resolved to wind up voluntarily, with Mr. G. Ensor Mount, of that address, as liquidator.

H. J. Swift & Co., ironmongers and electric appliance fitters and dealers, Earlestown, Lancaster.—Messrs. H. J. Swift and G. H. Herrod have dissolved partnership. Mr. Swift attends to debts, &c.

National Electric Traction Co., Ltd.—Creditors are to send particulars of debts, &c., to Mr. Leslie Morse (liquidator), 79, Queen Street, Cheapside, by December 7th.

Lansing, Griggs & Co., electricians and electrical engineers, Golden Gate Works, Old Trafford.—Messrs. E. Lansing and T. F. Griggs have dissolved partnership. Mr. Lansing attends to debts.

Peter Pilkington, Ltd., Bamber Bridge.—November 9th is the last day for receipt of proofs for intended dividend by James Todd, 3, Winckley Square, Preston, the liquidator of the company.

The Transvaal.—The value of the electric cables, wire and fittings imported into the Transvaal during the six months ending with June last is returned at £95,000, as compared with only £38,000 in the corresponding half of 1904.

Trade Announcements.—Mr. Robert Macgregor, for many years a partner in the firm of Messrs. W. Dunn & Co., Durban, Natal, has been admitted a partner in the firm of Rowland Carr and Co., of 6 & 8, Lime Street Square, E.C., whose business will be carried on as heretofore under the same style. We also learn that Mr. J. C. Brown, who is well known amongst electrical engineers throughout the kingdom, will now devote the whole of his attention to outside work.

The Consolidated Supply Co., Ltd., electrical engineers and manufacturers, Northampton Park, Canonbury, London, N., announce that, as from March 31st last, they have acquired from the Consolidated Electrical Co., Ltd., all that company's interests in the Northampton Works, together with the manufacturing business carried on thereat, including the benefits of carrying out all pending orders and uncompleted contracts as at the 30th ult. They have taken over all debts and other liabilities due to, or owing, or incurred by the Consolidated Electrical Co., Ltd., as from March 31st. The company have also acquired the business of Mr. A. K. Baylor, who has been appointed managing director, and the business heretofore carried out in his name will be continued under the name of this company. The company will continue and develop the businesses acquired.

Messrs. Generators, Ltd., 77 to 78, Trevelyan Buildings, Corporation Street, Manchester, have been appointed sole agents in their district for the various specialities—electric lifts, cranes, hoists, hauling plant, capstans, &c.—of Messrs. R. Harman & Co., of London, E.C.

Kilpin Hill Mills, Dewsbury, have been taken by the Dewsbury Electrical Manufacturing Co., Ltd.

The Rippingille Manufacturing Co., of Plume Street, Aston, Birmingham, are making a speciality of cast or sheet metal, including such supplies to own drawings or patterns for many Corporation tramway undertakings, also railways and manufacturers in different parts of the country.

Football.—The annual match, "Robertson Electric Lamp Works *v.* General Electric Co., London," took place on Saturday last on the lamp-makers' ground at Twyford Avenue, Acton, and, after an enjoyable game, the lamp-makers ran out the winners by 7 to 1. The lamp-makers have started their second season well, having won both their League matches. They are hoping to win another at the expense of Wigmore United on Saturday next.

Belgium.—The balance-sheet of La Compagnie Electrique Anversoise, of Antwerp, for the last financial year, shows a profit of £27,942 as compared with only £22,660 in the preceding 12 months.

Action against a Tramway Company.—At Stourbridge County Court on Thursday last week, before Judge Harrington, Messrs. Henry Wood & Sons, provision merchants, Dudley, brought an action against the Dudley, Stourbridge and District Tramway Co., for £30 damages in respect of a collision on March 6th. It appeared from the evidence that plaintiffs had sent a horse and cart out with goods on the day named. There were two men with the cart. It was stated that the horse was excitable, and one of the men got out to hold its head on the approach of a tramcar, which had been signalled to stop, and which, plaintiffs' witnesses said, did not do so till a collision had occurred. The man who caught hold of the horse was thrown down, a lamp-post was snapped off, and two windows in the tramcar were broken. Mr. Waldron, solicitor, who defended, called witnesses who stated that the tramcar did stop before the accident occurred, but the horse reared, and itself caused the mischief which ensued. The Judge said he could not help being convinced that the tramcar stopped before the accident happened, and that the driver had pulled up as soon as he could after he was signalled to do so. There must, therefore, be judgement for the defendant company.

Electrical Work in South Africa.—Electrical installations in South Africa represent an annual commercial value to the manufacturing countries of the world of more than half a million sterling, exclusive altogether of the large demands for complementary machinery such as boilers and steam engines, and of such material as tram-rails and cars. Of this amount about two-thirds is in respect of machinery, while another £100,000 must be set down for telegraph and telephone material. The remainder, approximating also to £100,000, is spent every year on general fittings and apparatus, including a great multiplicity of articles, such as switchboards, wires and cables, insulators, lamps of many varieties, ammeters and voltmeters, the smaller classes of ventilating fans, and an almost endless variety of accessory fittings. Exact figures of the South African imports of these goods are difficult to obtain; but it would seem that last year the value of the purchases of general electrical fittings and accessories amounted to something over £70,000, a sum probably equal to about two-thirds of that of the preceding year. The United Kingdom supplied £50,000, or over 70 per cent. of the total; Germany, £12,500; the United States, £5,500; Holland, £500; and Austria and Belgium a little over £300 each; showing that however much the United States may have gained the ascendancy in catering for the demand for electrical machinery, the monopoly is practically with English makers in accessories and fittings. South Africa, where electricity has so readily caught on, presents an alluring prospect in respect of the demands which will be made for fittings as the steady development of the country becomes an accomplished fact. Even at the present time mining and other industrial concerns and municipalities are vieing with each other in their efforts to push electricity to the limits of its commercial usefulness, and in stimulating its adoption for domestic and other purposes. There is hardly a third-rate township now which has not either adopted, or is about to adopt, an electric lighting scheme, and certainly no first-rate town is without its electric tramways; and the tendency, far from having exhausted itself, is gaining still further hold by industrial and general ramifications which will eventuate in a running demand for fittings far beyond the large annual sum even now expended.—*British and South African Export Gazette.*

An Electrical Exhibition in Russia.—This exhibition will be opened at Kiew in 1906. It will last three months, and will be placed under the patronage of the Association of Engineers of Russia and of the Municipal Council of Kiew. It will include the following sections:—(1) Boilers and other apparatus for the production of steam; (2) dynamos, alternators, and other generators; (3) electrical machines; (4) electro-chemistry and electro-metallurgy; (5) electric lighting; (6) transmission of motive power; (7) telegraphs, telephones and railway signals; (8) apparatus for measuring electric power; (9) electricity for medical purposes; (10) miscellaneous applications of electricity; (11) technical education. Foreign goods will be exempted from the payment of duty, and exhibits not sold within three months after the closing of the exhibition will be, in case of their return to the country of origin, transported free on Russian railways.

Steam Turbine Orders.—The successful setting to work of a number of steam turbines built by Messrs. Willans and Robinson, Ltd., of Rugby, has resulted in a large number of orders for their make of turbine, with the result that those departments of the Victoria Works, at Rugby, dealing with the manufacture of steam turbines are working day and night. Among recent contracts settled in favour of Messrs. Willans & Robinson's turbines may be mentioned:—

Four turbines of 1,000 kw. each, for the Cleveland and Durham Power Co.'s new station at Middlesbrough.

Three turbines of 1,000 kw. each, for Messrs. Bruce Peebles' Durham scheme for supplying power to a number of collieries.

Two turbines of 1,000 kw. each, for Messrs. Bruce Peebles' Fife scheme.

One turbine of 1,500-kw. capacity, for the Borough of Islington.

One turbine of 1,000-kw. capacity, for Messrs. Drake & Gorham.

Two turbines of 1,500-kw. capacity each, for the Borough of Shoreditch.

Book Notices. — *Modern Lightning Conductors.* By Killingworth Hedges. London: Crosby Lockwood & Son. Price 6s. 6d. net. — The author, who is the honorary secretary to the Lightning Research Committee, gives us in this book what he calls an illustrated supplement to the 1905 report of the above-named Committee. As this report has been already referred to in our columns, we need only say that in addition to the report and preface by Sir Oliver Lodge, it contains comments by the author on selected examples from the report, and an abstract of Lodge's 1902 paper on "Lightning Conductors." Modern methods of protection and the cost of installations are also dealt with, and the book will be of use to architects and others who are responsible for the design and safety of buildings.

"The *Mechanical World* Pocket Diary and Year Book for 1906." Manchester: Emmott & Co. 6d. net.

"Fowler's Electrical Engineer's Year Book and Directory of Light, Power and Traction Stations for 1906." Manchester: The Scientific Publishing Co. 1s. 6d. net and 2s. 6d. net.

"The Engineering Press Monthly Index Review." Vol. VI., No. 6, September, 1905. Brussels: Association de la Presse Technique. 2.50 fr.

"A Guide to the Electrical Examinations." By F. H. Taylor. London: Percival Marshall & Co. 1s. net. and 1s. 6d. net (cloth).

"Transactions of the Civil and Mechanical Engineers' Society.' 46th session, 1904-5. London: The Society, 25, Victoria Street, S.W.

"Die Zweckmassigste Betriebskraft." By F. Barth. Vol. I., Die mit Dampf betriebenen Motoren. Vol. II., Verschiedene Motoren. Leipzig: G. J. Goschen. 80 pfg. each.

"Die Gleichstrommaschine." By C. Kinzbrunner. Leipzig: G. J. Goschen. 80 pfg.

"Physikalische Grundlagen der Gleich- und Wechselstromtechnik." By A. Königswerther. Vol. I. Hanover: Gebrüder Jänecke. M. 2.60.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXI., Part 10. (Title, Contents, list of members, &c.). The Institution, 4, St. Nicholas Buildings West, Newcastle-on-Tyne.

"The Gas Works Directory and Statistics, 1905-6." London: Hazell, Watson & Viney, Ltd. 10s. 6d. net.

Consular Notes.—Turkey.—The Austro-Hungarian Consul at Beirut in a recent report states that that town, like the rest of Syria, possesses no electric plant. Damascus is, however, to have electric light and tramways. The cost of the whole plant is estimated at about £54,000. A company has been formed to carry out the work under the leadership of Izzet Pasha Bros. and Mustafa Bey. The Municipality has decided to pay to the company the sum of 8,000 Turkish pounds (about £7,200) annually.

Japan.—The German Consul at Kobe reports that the municipality of Osaka has received sanction from the Minister of the Interior for the construction of an electric tramway on the overhead system. The new line will traverse the extensive area of the town from north to south and from east to west, and will also be joined to the electric line which now exists, and which unites the town and the new port. The cost of building is estimated at 4,000,000 yen (£400,000, roughly). It is not yet known when the undertaking will be commenced.

Switzerland.—The Austro-Hungarian Consul at St. Gallen reports that a new company has been started in Arbon (Bodensee) with a capital of 500,000 fr., for the purpose of supplying electrical power in Bodensee-Thurthal. Electric current will be supplied from Rheinegg to Konstanz, and from Romanshorn to Frauenfeld. Contracts have been entered into with the electrical works "Motor," in Aargau, and "Kubel," in St. Gallen.

Spain.—According to the Austro-Hungarian Consul in Madrid, the La Maquinista Bilbaina Machine Factory, in Bilbao, has recently produced an electric automobile particularly adapted to Spanish requirements, which is chiefly remarkable because of its lightness and durability, combined with solidity of construction and relatively low price. The same factory is also at present engaged in the construction of an electric locomotive for Spanish railways. This is the first of its kind to be manufactured in Spain. Both these facts go to prove that Spanish manufacturers are beginning to interest themselves in the production of automobiles for passenger and goods transport in Spain. In many of the projects for railway construction in Spain, electric automobiles are to be used instead of steam. Certain Spanish firms are beginning to direct their attention to this matter, and the Consul thinks that there is an opening for foreign competition.

LIGHTING AND POWER NOTES.

Australia.—Sydney.—The Electric Lighting Committee has recommended to the City Council that Newtown should be supplied at the rate of £7 10s. per kw. per annum, plus 1d. per unit.

Melbourne.—The City Council has sanctioned an expenditure of £69,000 for the immediate extension of the electric lighting plant. Further works are to be undertaken which will bring the total outlay up to £72,400.

Bath.—The L.G.B. has considered the report made by Mr. Hooper on the application of the T.C. for a loan of £19,000 for E.L. purposes, and has sanctioned the borrowing by the Council of £18,120. The Board has deducted a sum of £798 for items of excess expenditure incurred for temporary works, spares, &c. The L.G.B. criticises as unsatisfactory the estimate on which it sanctioned a loan of £30,000, which had been largely exceeded, and points out that in the preparation of the scheme the actual requirements for the undertaking were not sufficiently ascertained before the estimate was prepared. It notes the fact that many alterations and additions were found necessary, and states that it seems that a considerable and unnecessary sum had been spent in this manner. With regard to the present financial condition of the undertaking, the Board warns the Council to proceed with the utmost caution in incurring any further capital expenditure.

Ballaghaderin.—An E.L. scheme for the town is being considered.

Birmingham.—The competition of suction gas in Birmingham has resulted in proposals for the reduction of both gas and electricity charges in the city. The Gas Committee has stated that it is prepared to reduce the price of gas for power purposes, from 1s. 10d. to 1s. 6d. per 1,000 cb. ft. The E.L. Committee also recommends reductions as shown below:—

	Present price per unit.	Revised price.
Lighting first 300 units per quarter	6d.	5d.
Over 300 units per quarter	4d.	3½d.
Electricity for power, first 300 units per quarter	3d.	2d.
Over 300 units	1½d.	1¼d.

For tramway purposes the charges are recommended to be:—

First 4,000,000 units	1½d. per unit net.
Second „ „	1¼d. „
Any quantity exceeding 8,000,000 units	1d. „

The revised prices, if approved, will come into operation at the commencement of the Christmas quarter.

Canada.—Moose Jaw (N.W.T.).—The T.C. has awarded contracts for an extension of the electric plant. The engine, boiler and accessories will be supplied by the Robb Engineering Co., Amherst, N.S., and the electrical apparatus by the Allis-Chalmers-Bullock Co., Montreal.

North Vancouver.—The British Columbia Electric Railway Co. proposes to establish an electric tramway, light and power system for this district, at a probable expenditure of $200,000. The company will increase the capacity of its generating station on the north arm of the inlet, by installing another 3,000-h.p. unit. A step-down sub-station which will be required, will be situated midway between North Vancouver and Moodyville, in which case electrical power will be available for the latter municipality.

Winnipeg.—The municipality has now connected up about 60,000 incandescent lamps, and new generators will be installed shortly to meet the large demand, which last year increased by 80 per cent.

Owing to the high price of oil, electric lighting is much more generally used throughout the North-West than in Eastern Canada, and in consequence it is profitable to install electric lighting plants in towns of much smaller proportions than in the East.

West Kootenay.—The West Kootenay Power and Light Co. proposes to spend about a million dollars in improvements to its power plant. The intention is to build a pole line *vid* the Dewdney trail from Rossland to Cascade, and thence to Grand Forks and Greenwood, so as to furnish power to the Granby Mining Co. and the British Columbia Copper Co. The distance over which the power is to be transmitted is upwards of 80 miles. A contract has been entered into with the Canadian General Electric Co. for the supply of two 4,500-kw. vertical type alternators, and two 150-kw. exciters. These being the first two of six generators of this size to be installed in the new power house, which will ultimately have a capacity of 30,000 h.p. It is understood that the generators in the present plant at Bonnington Falls will ultimately be closed down. The Canadian Westinghouse Co. have also received an order from this company to supply all the transformers for its new system. At the main station at Bonnington Falls six 1,875-kw. transformers, 2,200 volts to 60,000 volts, will be installed, also three 1,250-kw. inter-connecting transformers, 2,200 volts to 22,000 volts: three regulating transformers and one polyphase regulator, used in connection with the inter-connecting transformers. The various sub-stations of the West Kootenay Co. will have the following equipment:—At Grand Forks, six 1,250-kw. step-down transformers, 60,000 volts to 440 volts; at Phœnix, three 1,250-kw. step-down transformers, 60,000 volts to 2,200 volts; at Greenwood, three 1,250-kw. step-down transformers, 60,000 volts to 2,200 volts. These will all be oil-insulated water-cooled transformers for three-phase circuits.

Ottawa.—The Ottawa Electric Co. has decided to install at the Chaudiere Falls, a steam reserve plant, in addition to the plant already operated by this company as an emergency plant. The plant is to be in operation in four months, and will consist of a Westinghouse-Parsons steam turbine direct connected to a two-phase a.c. generator of 1,500 kw. A new boiler house is also to be built.

Grand Forks.—The Granby Consolidated Mining, Smelting and Power Co., is now installing the following additions to its plant in this township:—One 300-h.p. motor, three-phase, 400 volts 60 cycles; three 150-h.p. motors, three-phase, 400 volts, 60 cycles; two electric locomotives, 220 volts, 20-in. gauge; and one 75-h.p. three-phase, 400-volt, 1,120 r.p.m., 60-cycle induction motor, operating in a water-tight case for mine pumping service. The whole apparatus was obtained from the Canadian Westinghouse Co., at Vancouver.

Houlton (Maine).—The Maine and New Brunswick Electric Power Co. has secured a 15-year contract for the supply of light and power to the town. Plans and specifications are now being drawn up for developing the power of the Aroostook Falls, which is estimated at 3,000 h.p.

Westmount (P.Q.).—The T.C. has accepted the tender of the Robb Engineering Co., amounting to $8,300, for engines, accessories, and their erection, for the new lighting plant for the town.

Drummondville (P.Q.).—Tenders have recently been invited for the installation of a water and electric plant in the town.

Toronto.—Plans are about complete for the extension of the power transmission lines through the western peninsula of Ontario from Niagara Falls, London being the objective point for the present. Surveys are to be made through Brantford, Paris, Galt, Guelph, Berlin, Hespeler, Woodstock, Ingersoll and the smaller towns. Power supply is anticipated for Toronto by the end of the year.

Clacton-on-Sea.—The U.D.C. has decided to embark on an E.L. scheme at an estimated cost of £9,000.

Cleethorpes.—According to its agreement with the Grimsby Street Tramways Co. the Council has power to purchase the company's power station at Cleethorpes this year. After entering into negotiations with the company, the Council, on the

18th inst. resolved to defer the purchase for five years. It then undertakes to purchase the station for £15,400, less £640 depreciation.

Continental Notes.—Italy.—A company has just been formed in Milan with a capital of £18,000 to be known as La Società Elettrica del Ticino, to undertake electric lighting operations in the Vigerano and Mortara districts.

Application has been made to the Reggio Calabria prefectural authorities for sanction to put down a plant to utilise the water power of the Sfalasso, at Pitino, in the generation of electrical energy for lighting purposes.

France.—The Société Nimoise d'Eclairage et de Force Mòtrice par l'Electricité (The Electric Light and Power Co., of Nimes), is the name of a limited company which has been formed at Nimes. The capital of the company will be 500,000 francs, in 1,000 shares of 500 francs each.

Paris.—Under the title "Société d'Etudes pour l'Exploitation de l'Energie Electrique à Paris" there has just been formed a limited company, which has principally for its object the obtaining of the concession from the town of Paris of the future *régime* of electricity for that town. The capital will be 1 million francs in 100 shares of 10,000 francs each.

Lucerne-Engelberg.—The generating station at Obermatt was opened on September 1st last, for the supply of energy to the town of Lucerne for lighting and motive power purposes. The hydraulic plant utilises a waterfall of 300 metres; four units of 2,000 H.P. each are installed, generating three-phase and single-phase current at 6,000 volts. A part of the power is transmitted, by means of cables, to the town of Engelberg, distant about 4·5 kilometres, the greater part of the power is transformed to a pressure of 27,000 volts and transmitted to Lucerne, a distance of 28 kilometres, from there it is distributed to about 15 different localities. At Lucerne the pressure is lowered by 25,000 to 26,000 volts, and the current is there distributed partly as D.C., for supplying the electric tramways.

Dawlish.—The U.D.C. has been considering the question of the electric light and the position of the holders of the prov. order, who are not prepared to go on with the scheme at present. It has been decided to write to the Electricity Corporation, and ask them to apply to the B. of T. for an extension of the order.

Dungannon (Co. Tyrone).—The B. of T. has sanctioned an extension of the Council's E.L. order to November 15th.

East Ham.—On Tuesday the T.C. fixed a flat arc rate of 3½d. per unit, for energy supplied to places of worship in the borough.

Exeter.—It has been resolved to consider a complete schedule of the Langdon-Davies Motor Co.'s terms for the hire and hire-purchase of motors to electrical consumers, through the T.C.

Galashiels.—The T.C. is negotiating for the introduction of electric lighting in the town by a private company.

Glasgow.—The two 1,500-H.P. steam turbo-alternators by Messrs. Willans & Robinson and Dick, Kerr & Co. for the Port Dundas station will shortly be running, and arrangements have been made for the committee to inspect them.

Greenock.—Owing to the cost of laying the main (£2,000), the T.C. has declined to supply energy to the Cottage Hospital at Port Glasgow, but has informed the applicants that if they approached the Port Glasgow T.C. for a general supply to the burgh, arrangements might be made by the Corporation.

The T.C. has decided to apply to the Secretary for Scotland to authorise further borrowing powers.

The valuation of the electricity works has been fixed at £3,900.

Grimsby.—The Corporation has entered into an agreement with the G.C. Railway for providing a supply of electrical energy for use on the company's docks for a definite period of three years from the date such supply commences, and after that period from year to year, the agreement being terminable by 12 months' notice from either side. The railway company is to provide and lay the necessary feeder cables from the bridge at Doughty Road, along the railway to the sub-station to be built by it at the Dock Offices, and to pay for the necessary connecting cables laid on its own property between the Corporation distributors and the sub-station. The Corporation will provide the connecting feeder cables from the bridge at Doughty Road to the electricity works. The energy supplied is to be charged for on the maximum demand system at a fixed charge of £4 per annum per KW. of maximum demand, with an additional charge of ¾d. per unit for all energy consumed. The railway company is to take all electrical energy required by it at Grimsby from the Corporation, during the continuance of the agreement, except in the case of the present supply to the small installation on the fish pontoon, and in the case of the small installation existing in the transit sheds, where the energy is generated by the dynamos in the ships discharging cargo.

An interesting note appearing in the *Eastern Morning News* states that the Corporation Electricity Committee has agreed to supply energy to drive a small motor-generator to supply a private electrical installation. The electrical engineer warned the Committee that it was creating a "dangerous precedent," but the application was granted on the ground that the premises were wired for 100 volts, and that the applicant could not take a supply at the Corporation pressure of 230 volts without re-wiring his works. The applicant was, however, a town councillor.

Halifax.—The electrical engineer has been instructed to furnish the Hipperholme U.D.C. with details respecting a supply of electricity by the Halifax Corporation.

Hayward's Heath.—The U.D.C. has received terms from the local Electricity Supply Co. for a supply of energy for light and power, and negotiations are to be carried on with the company by a special committee.

Hornsey.—The T.C. has reduced the price of energy for power purposes to 2d.

India.—Cawnpore.—An official notification lately issued from Naini Tal, states that the Governor-General in Council has seen fit to supersede the licence sanctioned on February 18th last, then granted to Messrs. Begg, Sutherland & Co., for the electric lighting of Cawnpore, and to substitute fresh licences to be issued to the same parties. Whereas the previous licence gave the right to supply energy for electric traction purposes, the same rights are incorporated in the Cawnpore District Board Licence, Cawnpore Cantonment Electric Licence, and Cawnpore Municipality Electric Licence. In each case a D.C. supply is to be provided from a generating station within the municipal area.—*Indian Engineering.*

Liverpool.—During the past year the equivalent number of 16-C.P. lamps connected to the electric supply mains increased from 277,767 to 310,562, and the number of consumers from 5,345 to 5,821. The amount of energy used increased by about 6 per cent. over last year's consumption. The increase in tramways supply was 5·75 per cent., and the increase in the total output, about 6 per cent.

London.—Power Supply.—In regard to steps being taken to promote a municipal bulk supply scheme for London and district, a conference of local authorities has just been held, to which the following bodies were invited to send representatives:—Battersea, Bermondsey, Bethnal Green, Hackney, Islington, Poplar, St. Pancras, Shoreditch, Southwark, Stepney and Woolwich Borough Councils, East Ham and West Ham Town Councils, and Ilford and Leyton U.D. Councils. Steps are being taken towards the drafting of a Bill. The Battersea B.C. has, however, declined to send delegates. It is satisfied to leave the matter, at present, in the hands of the L.C.C.

Committees of the County Council have had the same subject under consideration for some weeks, and a resolution has been agreed upon that the Highways and Parliamentary Committees be authorised to make arrangements for a conference to be held next month, with representatives of the City Corporation, the Westminster City Council, and the borough councils, to consider the question. It has been further agreed that the electric lighting companies should be invited to express their views to the Council on the subject.

In commenting on the above, the *Daily Chronicle* says, "It is unfortunate that there should be two distinct Bills from the local governing authorities of London. . . . . So far as is known, the County Council has no designs upon the undertakings belonging to the Borough Councils. . . . . In order to fully discuss the matter, the Council is inviting a conference with the Borough Councils. . . . . The prospects of the power company will, of course, be the more hopeful in proportion to the differences between the central and local authorities."

Shoreditch.—Two more turbine generators are to be obtained by the B.C., at an estimated cost of £18,000.

Southwark.—On the 20th inst. a failure occurred in the electric light supply, and for a time several districts were in darkness. It was found necessary to close the public libraries, and in the workhouses artificial lighting had to be requisitioned.

Hackney.—The Finance Committee has approved of the following items of expenditure, in connection with the proposed taking of condensing water from the Lea Navigation for the purposes of the generating station:—Screening chamber, £470; pipe subway and trenches, £785; discharge chamber, £135; piping and necessary connections, £1,830; intake valves, penstocks and suction valves, cast-iron well, &c., £440; foundations, &c., £150; fees, £190; total, £4,000.

City.—The Charing Cross, West-End and City Electricity Supply Co. has informed the Corporation that it appealed to the Board of Trade against the conditions of the Corporation's consent in March last, in regard to the company's application for a change of pressure from 100 to 200 volts in those parts of the western area of the City where supply at 100 volts is now being given. The Board has consented to the change of pressure, subject to (1) that the undertakers provide a proper means for testing the public and private supply of energy; (2) that they pay to consumers the reasonable cost of the change; (3) that disputes arising under Condition (2) shall be referred to an arbitrator appointed by the Board.

The Cattle Markets Committee has agreed to take a supply of energy for lighting the foreign cattle market, at Deptford, from the London Electric Supply Corporation, at 1½d. per unit.

Marylebone.—The Electric Supply Committee reports that the total number of consumers changed over to the increased pressure of supply was, on the 17th inst., 1,047. The chief difficulty in connection with the change-over was due to the engineer being unable to obtain information as to the consumers' insurance companies, these companies having to be approached with a view to obtaining their endorsement to the respective fire policies. The Finance Committee reported having drawn cheques during the recess to the amount of £54,000 on account, to contractors for works in connection with the electricity undertaking.

Morecambe.—The past year's working of the corporation electricity undertaking has resulted in a loss, but the gross profit has increased from £1,798 to £2,155.

Newport (Mon.).—At a meeting of the Electricity and Tramways Committee of Newport Corporation held on Tuesday, a joint report was presented by the electrical engineer, Mr. H. Collings Bishop, and the secretary, Mr. J. G. Ellis, recommending a considerable reduction in the charges for electric light and power in the town. After consideration it was decided to recommend the Corporation that from January 1st next the charges for shops, public houses, public works, public buildings, &c., be reduced from 5½d. to 4d. per unit, if the consumption reached 6,000 units per annum, and for all electricity consumed above this the charge to be 3d. per unit per annum. For offices there will be a reduction from 5½d. to 4½d., and for private houses, and places of worship from 5d. to 4½d. The prices for heating and cooking will be lowered from 2d. to 1d. per unit. The Committee also decided to hold an up-to-date electrical exhibition at an early date.

New York.—The Municipality has purchased for £730 the existing wires and fittings on the Williamsburg Bridge, in preparation for the starting of the Municipal generating plant designed to light this structure. The plant, which is of 400 H.P., will cost about £20,000.

South Africa.—DURBAN.—The T.C. has resolved to install mechanical stokers to four other boilers, of the "chain-grate" type, similar to those recently obtained, at a cost of £1,240, and a further £700 for the structural alterations. A recommendation to install about a dozen prepayment meters on consumers' premises was also approved of.

Accidents are of rare occurrence with the bare overhead distributing mains in Durban, but on September 25th a horse was electrocuted, due to a wire carrying 200 volts falling across the roadway. It seems that the wire, which passed very close to a telephone pole, came in contact with the same, and fused at that point, telephone reconstruction work which was being carried out in the locality being probably responsible for the contact.

KLERKSDORP.—The Government electrical engineer has considered the report on the E.L. scheme drawn up by Mr. Dagnall, and is of opinion that the scheme, on the whole, could be recommended to the Lieut.-Governor for approval.

Swindon.—The Hospital Board has decided to have the E.L. installed at the Isolation Hospital. Gas last year cost £172 2s. 9d., and the borough electrical engineer advised the Board that at the flat rate of 4d. per unit, 90,000 lamp-hours (16-C.P. lamps) would cost £90 a year, and on the maximum demand rate £71. If larger lamps were used the respective annual cost would be £98 and £78, and with 25-C.P. lamps, £120.

Tokio.—La Tokio Shigai Tedsudo (Tokio tramways) is forming a company with a capital of 15,000,000 yen. This is the largest electrical undertaking of Japan, and even in the East. It possesses 37 plants for the production of electricity, at Tokio and in the other large towns of Japan. These represent some 35,000 H.P.

Wembley.—The U.D.C. notifies in the *London Gazette* that it is applying for a prov. order.

Woodford.—The U.D.C. has decided to promote a Bill authorising it to supply energy, and will proceed forthwith with the application to the B. of T. for a prov. order.

TRAMWAY AND RAILWAY NOTES.

Bournemouth-Swanage Light Railway.—The Poole Harbour Commissioners have given their consideration to the application made by the promoters of the Bournemouth, Parkstone, Studland and Swanage Light Railway for the consent of the Commissioners to the scheme as affecting the harbour. The proposal is to construct a light railway between Bournemouth and Swanage, and to cross the harbour entrance by a stiffened suspension transporter bridge. From the plans which have been submitted to the Commissioners, it appears that the span and headway are to be as following:—Clear span of waterway, 400 ft.; clear headway underside of girders to high water ordinary spring tides, 90 ft.; clear headway underside of conveyor car to high water ordinary spring tides, 9 ft. 6 in. It is stated that the conveyor car will pass from one side to the other in 1½ minutes, and can be brought to a standstill in its own length, viz., 50 ft., without causing inconvenience to the passengers, and that in case of necessity it could be stopped dead by reversing the machinery. The Commissioners consider that there is nothing objectionable in the scheme, provided adequate means are taken to prevent hindrance to navigation. They require that the span of the waterway shall be from shore to shore, so as to prevent any possible impediment to the free navigation.

Bradford.—The Corporation Tramways Committee has invited the B.E.T. Co. and the Cleckheaton U.D.C. to discuss with the Committee the suggested extension of the electric tramways from Wyke to Low Moor and Oakenshaw.

The Corporation has decided to equip the whole of the cars with the "run back" brake at an estimated cost of £3 10s. per car.

Cape Town.—Traffic on the Kenilworth-Wynberg section of the Cape Town to Wynberg electric tramway was temporarily interrupted on September 29th, owing to some trees having been blown on to the track during a heavy storm. Considerable damage was done to the lines of the Cape Peninsula Lighting Co. by the same storm.

Continental Notes.—The Alioth Electric Co., of Bâle, and Messrs. Vallière & Simon, engineers, of Lausanne, have obtained from the Swiss Government a concession for the construction and working of an electric railway from Sépey to Ormont-Dessus.

East Ham.—It was reported at the T.C. meeting on Tuesday that a letter had been received from the North Metropolitan Tramways Co. stating their willingness to consider a proposal to take over their lines, &c., in Romford Road. Delegates were appointed by the T.C. to open up negotiations with the company.

Falkirk.—The B. of T. inspection of the new electric tramways took place last week, and the system was opened for traffic on Saturday. The route covers 6¼ miles, the track being single, with turn-outs. The steepest gradient is 1 in 15½. Power is supplied by the Scottish Central Electric Power Supply Co. from the company's power station at Bonnybridge. There are 18 double-decked cars, accommodating 48 passengers each. Messrs. Bruce Peebles & Co., Ltd., were the contractors, and the estimated cost of the undertaking was £60,000.

The company intends to apply for a prov. order to run the cars to Laurieston, about a mile east from Falkirk on the Edinburgh road, and also to Grangemouth, 2½ miles north-east from Falkirk.

Harlingden.—For the reconstruction and electrification of the tramways within the municipal borough, the Harlingden Corporation proposes seeking Parliamentary powers during the coming session. At present the town's tramway system is part of that owned by the Accrington Steam Tramway Co., which runs from Accrington, through Harlingden to Rawtenstall. It is proposed to extend the reconstructed system to Three Lane Ends, Helmshore and Ewood Bridge, all within the borough of Harlingden.

Huddersfield.—The tramway receipts for the half-year ended September 30th last, according to a report presented this week to the Huddersfield T.C., amounted to £38,298. The total working expenses were £19,010. The surplus was drawn upon to the extent of £12,257 for payment of interest and redemption fund charges, leaving a balance of £7,030.

India.—An Indian contemporary states that preliminary estimates for the electrification of the Kalka-Simla Railway are to be prepared by order of the Government.

Leeds.—The revenue returns of the Corporation tramways for the financial half-year, from March 26th to September 30th, which have just been published, show gross receipts to the amount of £165,226—an increase of £4,136 on the corresponding period of last year. The car-mileage is now 3,674,307, an increase of 65,571. The gross profit in the last half-year was £79,072, an increase of £3,543.

The Leeds electric tramway service is about to be extended to Horsforth. The Horsforth District Council some years ago transferred its prov. order for tramways to the Leeds Corporation, and later the Corporation obtained Parliamentary powers to construct the lines and work them. The main track from Kirkstall Abbey to Calverley Lane End, Horsforth, was opened for traffic in the autumn of last year, the Corporation having in view a further extension to Rodley, and eventually to other outside districts. Such a policy involved the introduction of a high-pressure generating system in place of the low-tension system then in use, and arrangements were accordingly made for extending the power station in the Calls. Difficulties arising from the proximity of the river being overcome, the work is now rapidly progressing; still, it is doubtful whether the plant, which includes a couple of turbines of the Curtis vertical type, will be ready for use before the end of the year. Current will be generated at a pressure of 6,500 volts three-phase, and will be distributed from the central station to two sub-stations which are being erected, one at Bramley Town End, and the other at Hawkesworth, Kirkstall. At these points there will be transformers and rotary converters for changing the current to the pressure required for use by the cars.

Mexico.—Plans are being prepared in respect of a projected electric tramway between Mexico and Puebla. Water-power will be utilised in the generation of the necessary electrical energy.

Middlesbrough, Stockton and Thornaby.—The whole of the overhead trolley wire on this tramway is to be renewed, amounting to nearly 18 miles. The existing wires have been in use for seven years. Flexible suspension will be used in future.

Torquay.—The Dolter Co. recently stated that the application of the Corporation for an extension of time and delay in the construction of the tramways to give the Corporation further time to consider the question of paving had been acceded to by the B. of T. This delay was totally unexpected, and the directors of the company, who had offered to lay any paving material, however costly, that met with the approval of the Council, and who had received an official approval of the paving blocks from the borough engineer, are greatly perturbed thereby.

(Continued on page 683.)

AN EXPERIMENTAL AMERICAN ELECTRIC RAILROAD.

By E. GUARINI.

A short time ago, a series of interesting tests was carried out on a section of the main line of the New York Central and Hudson River Railway, which was electrically equipped by the General Electric Co., of Schenectady. For this purpose a stretch of 6 miles of the east-bound local tracks of the New York Central was selected, a few miles beyond the city of Schenectady, and this was equipped with the standard third-rail construction. The track is practically straight, and is ballasted so as to permit of a maximum speed of 70 to 80 miles per hour being obtained. Power is furnished by a 2,000-kw. three-phase 25-cycle Curtis turbo-generator, delivering 11,000 volts to the line. The generator is located in the new power house of the G.E.C. at Schenectady, and supplies energy by a high-pressure transmission line to a sub-station at Wyatts, located at the centre of the 6-mile stretch of track. Here the 11,000-volt alternating current is stepped down and converted to 600-volt direct current, at which pressure it is delivered to the third rail.

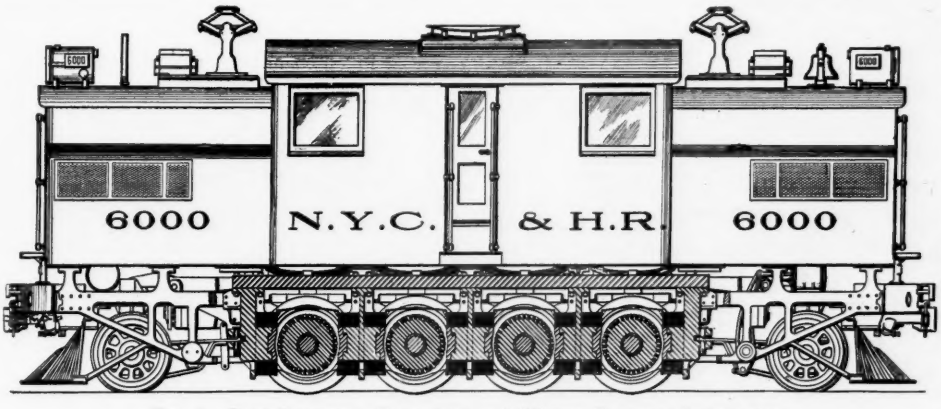


Fig. 1.—Part Sectional Elevation of 2,200-h.p. Electric Locomotive.

A feature of the locomotive is the ease with which it runs, as well as the comparatively little noise made. The rocking motion of the steam locomotive is absent, and it is difficult to realise the high speed which is being attained. There are four pairs of driving wheels, and two pony trucks for guiding the locomotive around curves. It has been sought in this machine to retain the best mechanical features of the high-speed steam locomotive, combining them with the enormous power and the simplicity of control made possible by the use of electricity as a driving agent. The superstructure of the locomotive is of sheet iron, arranged so as to house all the controlling mechanism and accessories, and yet leave a clear view for the driver. The greatest departure from ordinary practice in electric locomotive construction is in the method of applying the electric drive, which is direct.

The motor armature is mounted directly on the driving axle, without the spring-suspended quills which are a feature of the gearless electric locomotives used in the Baltimore and Ohio tunnel. Within the cab the controlling devices are arranged in duplicate, so that a locomotive can be easily handled when running in either direction. There is a central passage-way through the locomotive, enabling it to be entered from the car attached to it. The superstructure is practically in three sections, the central one being an operating cab containing the indicators and the controlling handles, and the two end ones housing the contactors, rheostats, reversers, &c. These devices are arranged along the sides of the central corridor in boxes of sheet-steel, which are sheathed on the inside with fireproof insulating material. All the parts here are easily accessible for inspection and repairs.

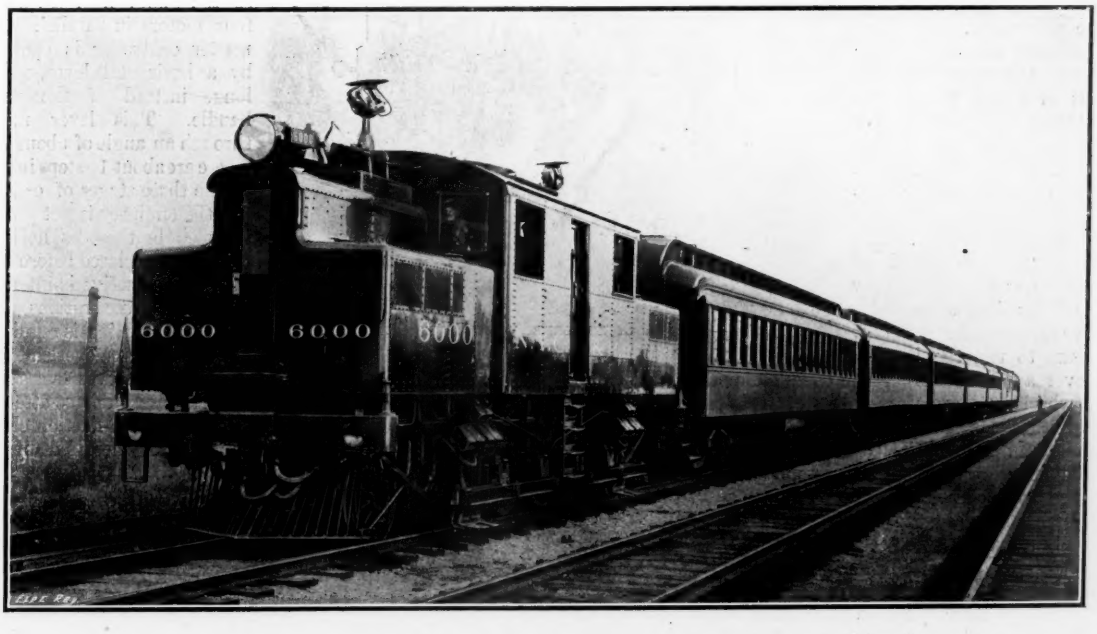


Fig. 2.—Electric Locomotive and 7-Car Train, New York Central and Hudson River Railway.

F

The four axles of the locomotive are spaced equal distances apart, each mounting the armature of a 550-H.P. motor. Between every pair of axles, and outside of the outer two, on either side of each armature, are the magnetic

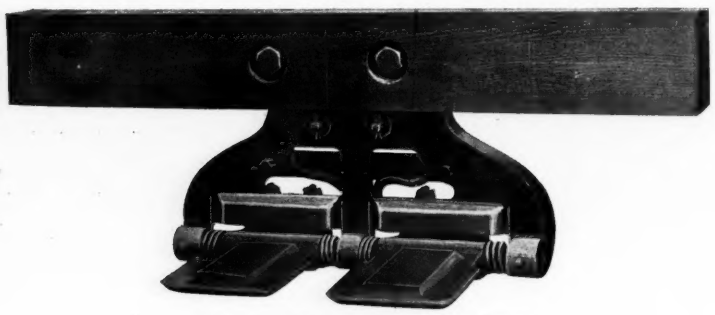


Fig. 3.—View of Collecting Shoe.

poles, two to each motor; these are arranged in tandem, the magnetic flux passing directly through the four armatures in series, and returning through the cast-steel side frames of the truck. The pairs of poles are carried by heavy steel transoms bolted to the side frames, which provide an ample by-pass at intermediate points for carrying the magnetic flux should unbalancing occur. The pole-pieces are very nearly flat, and sufficient clearance is left in the air-gap to allow for the play of the armature. At the same time, the poles are so shaped that this movement of the armatures does not distort the magnetic field. This condition can only be obtained in a two-pole type of motor. The field coils are of heavy strip copper, wound flat upon metal spools, which are bolted to the pole-pieces.

Practically the entire space between the two driving wheels is taken up by the armature, possibly one-third of the longitudinal space being occupied by the commutator. A large commutator is necessary in this design, as there are but two sets of brushes. The main journals are outside of the wheels, and are thus easily reached for inspection. To remove an armature it is only necessary to run the locomotive over a pit and lower the complete unit, consisting of axle, wheels and armature, into it. It is not necessary to disturb the fields or any other part of the locomotive, and a new unit can be put in place as easily. The brush-holders are mounted on insulated supports attached to the spring saddle over the axle journal, and are thus maintained in a fixed position relative to the commutator.

The brushes are placed on a horizontal axis, so that any little vibration set up will not affect them; and the brush-holders are made adjustable so as to allow for wear of the commutator and journal bearings. The dead weight on the axles is said not to be materially greater than that customary with steam locomotives, while in contrast to the latter there are no reciprocating parts and no unbalanced weights to produce vibration. It is thought that this feature will have a considerable effect in reducing the expense of maintaining the rails and the road bed, as there will be no rolling or pounding. To obtain a proper distribution of the weight of the locomotive upon the four axles, a system of half-elliptic springs and equalising levers of forged steel is employed, and the whole is so arranged as to cross-equalise the load and furnish three points of support. The mechanical simplicity of the arrangement of the truck and the motors is striking. The motors, in fact, form a part of the truck, and are not, as heretofore, separate machines supported by the truck. The design at the same time is strong and one offering every facility for repairs and renewals.

The pony trucks which are placed at the two ends of the locomotive for guiding, are similar in design to the standard construction adopted by the New York Central for its steam locomotives. They are pivoted, by means of radius bars, to the end frame of the main truck: the frame of the locomotive above the truck is supported by means of suitable links, so that the truck is free to swing about its centre, and is self-centring on a straight track. A brake air compressor, placed in the locomotive cab, consists of a G.E.C. motor-driven air compressor, with a capacity of 75 cb. ft. of free air per minute. This is a twin vertical cylinder compressor, driven by two 600-volt direct-current series motors, and controlled by a governor, which automatically cuts the motors in and out of circuit when the air pressure rises or falls above or below 125 lb.

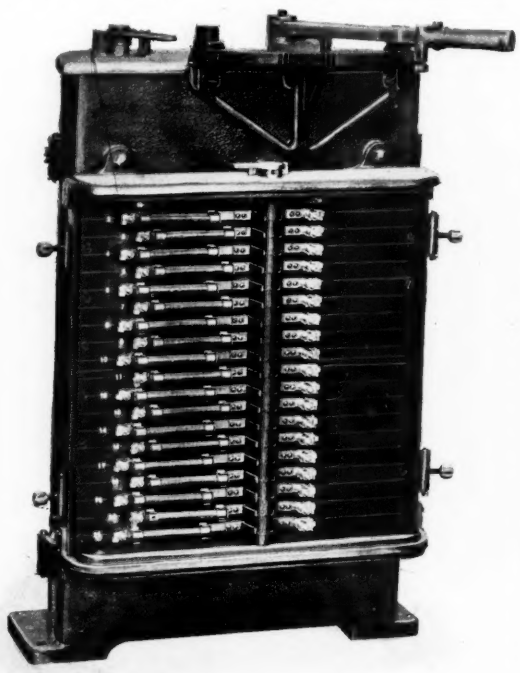


Fig. 4.—Master Controller, with Cover Removed.

The system of control gives three running combinations: First, with all four motors in series; second, with two groups in parallel, each group consisting of two motors in series; and, last, with all four motors in parallel. The master controller is operated by a horizontal lever, 24 in. long, instead of the usual handle. This lever moves through an angle of about 75°. There are about 10 steps in each of the three stages of control, but the engineer is not guided so much by these as he is by the ammeter placed before him. As the locomotive is intended for high accelerations, the process of starting is regulated so as not to overload the motors. For this purpose the ammeter serves as a guide. At the same time there is a current-limiting device attached to the master controller, which consists of a friction clutch operated by an electro-magnet which is energised by the current passing through one of the motors. This arrangement is such that, when the current exceeds a pre-determined amount, the clutch locks the controller cylinder, preventing it from being moved until the current has fallen sufficiently to release the clutch.

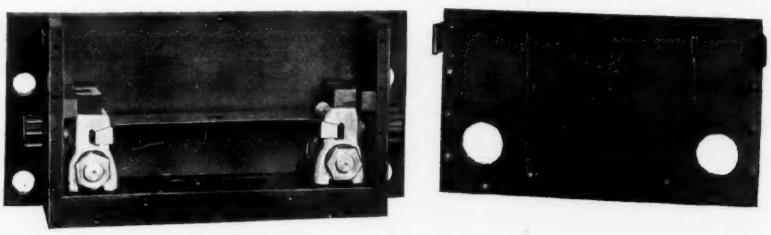


Fig. 5.—Fuse Box, with Cover Removed.

The tests already made indicate what may be expected of a locomotive running in regular service. With an eight-car train weighing 336 tons, exclusive of the locomotive, a maximum speed of 63 miles per hour was reached and 72 miles per hour with a four-car train weighing 170 tons. In the starting tests, a speed of 30 miles per hour was reached in

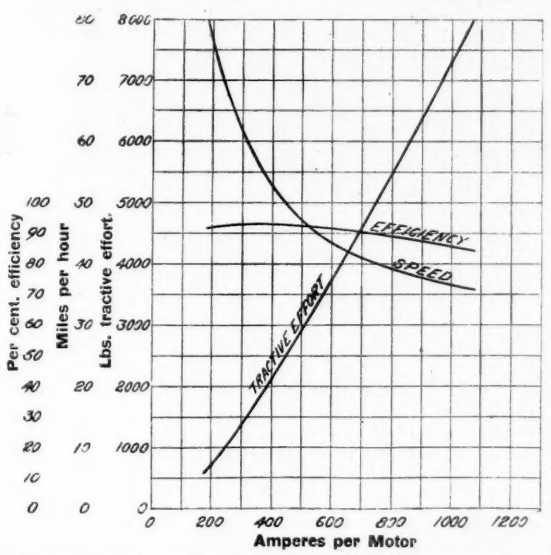


Fig. 6.—Characteristic Curves of G.E. 84 Motor, 600 volts.

60 seconds with an eight-car train weighing, including the locomotive, 431 tons, this corresponding to an acceleration of ½ mile per hour per second. During certain periods of the acceleration, the increase in speed amounted to 0·6 mile per hour per second, calling for a tractive effort of approximately 27,000 lb. developed at the rim of the locomotive drivers. This value was somewhat exceeded with the four-car train,

Fig. 7.—View on the Track, showing a Railway Crossing.

where a momentary input of 4,200 amperes developed a tractive effort of 31,000 lb. at the drivers, with a coefficient of traction of 22·5 per cent. of the weight on the drivers. The average rate of acceleration with the four-car trains weighing, including the locomotive, 265 tons, was 30 miles in 37½ seconds, or 0·8 mile per hour per second, calling for an average tractive effort of 22,000 lb. The maximum input recorded, 4,200 amperes at 460 volts, or 1,935 kw., gives an output of the motors of 2,200 h.p. available at the wheel. With 4,200 amperes and a maintained potential of 600 volts, there would have been an input of the locomotive of 2,520 kw., corresponding to 2,870 h.p. output of the motors. This output is secured without in any way exceeding the safe commutation limit of the motors and with a coefficient of traction of only 22·5 per cent. of the weight on the drivers, thus placing this electric locomotive in advance of any steam locomotive yet built. No service capacity temperature runs have been made as yet, and the preliminary tests have not shown any appreciable warming of the motors sufficiently to take thermometer readings.

Judged from the standpoint of its magnitude and the far-reaching results which must follow, the electrical equipment of this railway is the most important event that has happened in the application of electrical traction to steam railroads. The novelty of the work lies in the great magnitude upon which it is being carried out: the elaborate and carefully-systematised experimental work carried out near Schenactady, and the important bearing which this will have upon the great question of the electric operation of long-distance railroads between such points as New York and Chicago, or New York and Pittsburg, or Washington.

The express service will be separated from the local service, the express trains being hauled as far as the terminals by electric locomotives, and the local trains being operated on the multiple-control system as used on the elevated and subway lines. This separation of the service will involve the four-tracking of these roads, and, indeed, on some portions there will be as many as eight tracks.

INDEPENDENT CONDENSING PLANT FOR THE SCOTTISH CO-OPERATIVE WHOLESALE SOCIETY.

The adoption of independent condensing plants as a means of securing greater economy in the working of electric power stations is at the present time causing a very great interest to be taken in their arrangement and general detail. The necessary knowledge which is required for the proper designing and construction of a

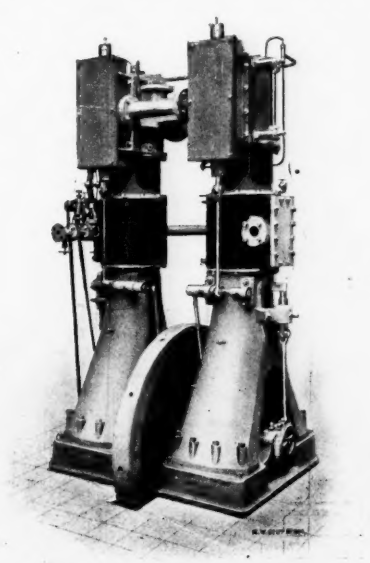


Fig. 1.—Mirrlees-Watson Dry-Air Pumps.

good condensing plant can only be obtained by experience, as there are so many points and wrinkles that have to be borne in mind in connection with it. At the power station recently inaugurated by the Scottish Co-Operative Wholesale Society, Ltd., at their works at Shieldhall, there is a very comprehensive condensing plant supplied by the Mirrlees-Watson Co., of Glasgow.

These extensive works at Shieldhall comprise about 20 different factories and employ over 7,000 hands. The central power house is placed alongside the railway siding, and provides the energy for

driving the whole of the machinery in addition to that required for the complete lighting installation.

Steam is supplied by four Stirling water-tube boilers at a working pressure of 150 lb. per sq. in. The revolving grate bar furnaces

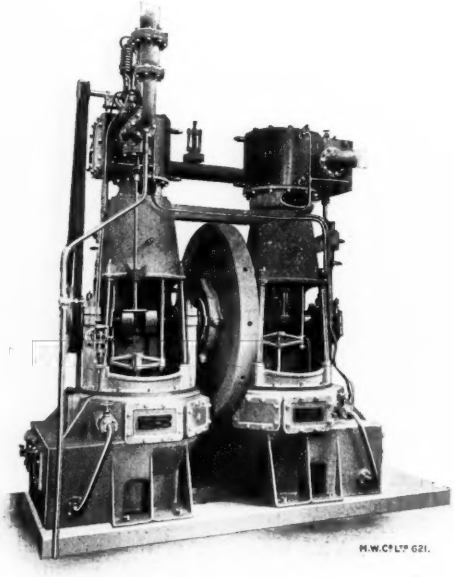


Fig. 2.—Double-Acting Condenser Water Pumps.

are fed automatically through shoots leading from the overhead coal bunkers; the underside of these are formed to receive measuring boxes for weighing the coal supplied to the boiler furnaces.

An elevator (constructed by Messrs. Blake, Barclay & Co., of Greenock), which is of the curve type, raises the coal from a pit under the railway siding, up over the main line to the overhead bunkers. The coal conveyor is of the double strand roller chain and push-plate type, the trough being constructed of cast-iron and having the necessary discharging doors. The motive power for the elevator and conveyor is obtained from a shunt-wound electric motor. The motor runs at 800 revs. per minute, and is provided with a raw hide pinion engaging with a train of spur wheel gearing. The elevator is geared to a speed of 70 ft. per minute, and the conveyor to 80 ft. per minute.

The capacity of the plant is 25 tons per hour, and working at this load the power required (6 B.H.P.) to drive the installation is abnormally low, this being no doubt due to the adoption of roller friction on the working pins throughout.

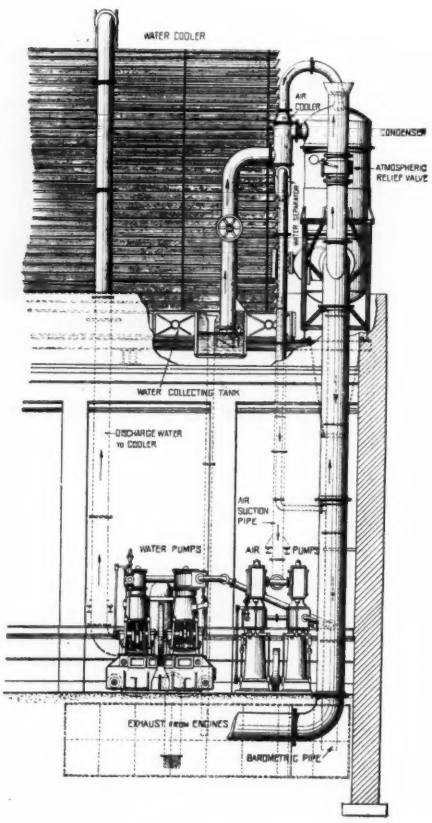
The ash handling plant consists of small trucks running on rails below the boiler furnaces, where they catch the falling ashes and tip them into the boot of the elevator, from which they are lifted up and discharged into a receiving hopper outside building, for carting away.

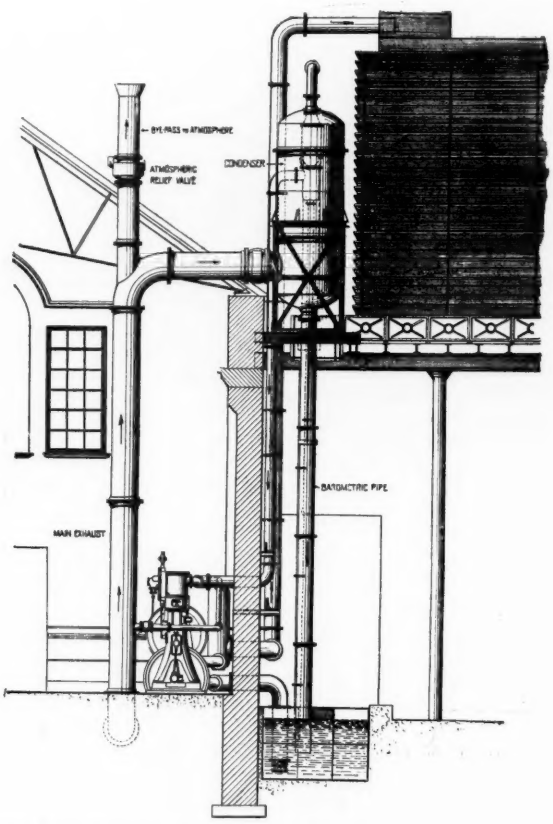
The whole arrangement was designed Mr. Jas. Stewart, the engineer of the Scottish Co-Operative Wholesale Society, Ltd.

The engines are of the high-speed enclosed type, made by Messrs. Browett, Lindley & Co., there being three sets, each of 400-KW., and one of 250 KW. capacity. The exhaust steam is led into a common exhaust main, and thence to the independent condensing plant, which is of the elevated jet type.

This condensing plant consists generally of a jet condenser of the elevated self-draining type erected over the boiler house roof; a set of steam-driven dry air pumps, steam-driven water circulating pumps, and an open type water cooling tower, which is erected over a tank carried on the boiler house roof, as illustrated in the general arrangement of the plant. The condenser is fixed at such a height that the vacuum obtained in it is sufficient to allow the pressure of the atmosphere to raise the cooling water from the collecting tank under the tower into the top of the condenser, and also such that even with a perfect vacuum in the condenser, the discharged water in the condenser tail pipe cannot be raised by atmospheric pressure to a height which would allow of its getting into the exhaust steam main. The bottom end of the condenser tail pipe dips into a smaller water tank, the end of the pipe being effectually water sealed. From this tank, the water is taken and delivered by means of the water pumps over the cooling tower, falling from there into the large cooling tank, ready for use in the condenser. There is a branch on the exhaust steam pipe close to the condenser, fitted with an automatic exhaust relief valve.

The condenser is constructed of mild steel plates, and is fitted internally with a number of water distributing trays arranged alternately round the shell, and in the centre of condenser. The water entering at the top of the condenser falls successively over these trays in the form of circular cascades, through which the steam is bound to pass on its course towards the top of the condenser. The air and non-condensable gases are drawn off from the top of condenser at a low temperature and volume; these gases are afterwards led through an auxiliary cooler and separator, the cooler being fitted with a number of brass tubes, through which the gases pass on their way to the dry





Figs. 3 and 4.—Sectional Elevations showing Arrangement of Condensing Plant.

air pumps; the cooling water on its way to the condenser passing around these tubes absorbs a further quantity of heat from the gases, thus giving them the minimum temperature and volume, with the result that the air pumps may be of smaller capacity than would otherwise be the case. Any water which may be carried from the condenser by the air is collected by the separator and discharged into the condenser tail pipe. The combined cooling and condensed water falling to the bottom of the condenser passes out close to the steam inlet and therefore approximates in temperature to that of the steam. By this arrangement a minimum quantity of cooling water is necessary.

The air pumps, shown in fig. 1, are designed to deal with dry air only; there are two cylinders fixed tandem fashion above the high and low pressure steam cylinders of a cross compound vertical engine. The air cylinders are of double-acting type, and the admission and discharge of the air are controlled by a slide valve having a special equalising port, which makes connection between the two ends of the cylinder when the piston reaches the end of its stroke; this reduces the pressure of air filling the clearance space at the discharge end to approximately the pressure in the condenser. By this arrangement a volumetric displacement efficiency of about 95 per cent. is obtained.

The water pumps, shown in fig. 2, are of the double-acting reciprocating type. There are two pumps driven by side rods from the cross-heads of a vertical cross compound engine. The pump valves are of special design, having a double opening, and giving a large area of opening with a very small lift, thus allowing the pumps to be worked at a higher speed than the ordinary type.

The plant, as illustrated, is designed to deal with 48,000 lb. of exhaust steam per hour.

TRAMWAY AND RAILWAY NOTES.

(*Continued from page* 678.)

London.—CITY.—On Thursday last week the City Corporation discussed a recommendation of the Bridge House Estates Committee, that a Bill be promoted in the next session of Parliament to empower the Corporation to widen Blackfriars Bridge, or to construct a new bridge over the Thames, for the accommodation of the L.C.C. tramways, out of the revenues of the Bridge House Estates. The report was carried by an overwhelming majority.

CAMBERWELL.—A letter has been received by the B.C. from the Highways Committee of the L.C.C., stating that the Committee cannot see its way to recommend that any of the schemes suggested by the B.C. for the construction of tramways to the Crystal Palace be submitted to Parliament next session. The proposals of the B.C., however, will be carefully considered in connection with schemes for the session of 1907.

LONDON COUNTY COUNCIL.—On Tuesday, Mr. Cornwall, the chairman of the Council, submitted a lengthy review of the work of the Council in the past year. After referring to the rejection by the House of Lords of the over-bridge tramway Bill, the chairman proceeded to say:—

"In its tramways the Council possesses the actual means of providing cheap and speedy transit. Of the 115 miles of tramways within the county, 97½ miles were owned by the Council on March 31st, 1905. Of these the Council itself worked 47 miles, of which 26¼ miles have already been adapted for electric traction. This is a necessity for rendering tramways a more speedy means of transit than would otherwise be possible, and among other advantages enables a much greater number of people to be accommodated. The total number of passengers carried during the year was 164,818,560, or 31,679,475 more than in the previous 12 months. The fares that are in operation are low; and special facilities are given to workpeople, extensive workmen's car services with a maximum fare of 1d. single, 2d. return or double-journey, being in force on all the lines.

"The power for working the Council's tramways is still obtained from temporary sources of supply, but the erection of the generating station at Greenwich is proceeding apace, and when the first portion is finished, which it is anticipated will be early next year, power will be available at less cost than has hitherto been the case. With a view to securing at the earliest possible moment for the residents in districts served by the Council's northern tramways the advantages already in part possessed by south Londoners, the Council was for some time during the year under review in negotiation with the North Metropolitan Tramways Co., to whom the northern lines are leased, for the surrender of its lease to the Council. These negotiations have since been brought to a successful termination.

"In addition to its ordinary surface lines, London will soon be in possession of a shallow underground tramway. The original intention was to construct this from Southampton Row to the Victoria Embankment, and it would thus have afforded the inhabitants of Pentonville and further east an opportunity of diversifying their ordinary modes of recreation with an occasional journey from their crowded districts to the very different scenes of the Embankment. Up to the present, however, the Council has only obtained power to construct the tramway as far as the Strand, and in this curtailed form the scheme is fast approaching completion. The view of the possible use of this tramway which I have put before you leads me to draw attention to the facilities which the Council's tramways afford in providing easy access to the parks and commons of London, nearly the whole of which, with the exception of the central parks, are situated upon or within a short distance of the tramway routes. The natural relation of the two services of parks and tramways is well shown in the United States, where nearly 300 tramway companies own and manage public parks as an integral portion of their undertakings.

"The Council is at present incurring large expenditure in connection with the improvement of its tramways, and this will be greatly increased in the near future. The immediate electrification of the northern system is a work to which the Council should apply itself with the utmost energy. The cost will be something between four and five millions, but we may, I think, feel assured that the financial results will be satisfactory. These, however, are not everything. The better health and increased comfort of the community that will result are of immense value, although necessarily difficult to express in pounds, shillings and pence.

"The policy which the Council has pursued with regard to traffic communication and tramways during the last sixteen years has since been embodied in the report made by the Royal Commission on Traffic Communication. We should not have dared to place such a huge scheme before London as their proposals involve. This is not because the Council is unconscious of the needs of London, for who could be more sensible of those needs than those who are elected every three years from all parts of London by the people for whom traffic facilities are needed?

"Our Highways Committee for many years past has had before it in one form or another all the points which seem to have influenced the Royal Commission; and it must be gratifying to those members of the Council who have made a special study of traffic communication to find that so high an authority as the Royal Commission recommend in a large degree the policy which the Council has pursued in locomotion and transit matters during the 16 years of its existence.

"In view of the concurrence of the Commission in the Council's views, is it to be wondered at that many of us upon the Council should be of opinion that the best tribunal for dealing with the great question of traffic communication is the London County Council?"

Lieut.-Col. Yorke, who has been engaged on an inspection of the L.C.C. tramways, recently reported to the B. of T. in favour of a general increase of pace, as requested by the Council, except when passing under low bridges and when rounding curves and passing facing points. He suggests that the speed may in future be increased from the Horns, Kennington, to the Plough, Clapham, from 10 to 12 miles; the Plough to Nightingale Lane, from 12 to 16 miles; Nightingale Lane to Tooting terminus, from 10 to 12 miles per hour.

Newark.—At the B. of T. last week, Sir Herbert Jekyll presided over a hearing of objections to an order issued by the Light Railway Commissioners, authorising the construction of light railways in the borough and rural district of Newark.

Oxford.—The T.C. has appointed Mr. Stephen Sellon to value the tramway undertaking, and has resolved to promote a Bill in the next session of Parliament giving powers of purchase.

Penge.—The laying of the double line of rails from the South Norwood border along the Croydon Road to Penge is now practically completed, and this section of the extension will probably be opened early in the new year, instead of in April, as promised by the B.E.T. Co. As is well known, this company is the lessee of the Croydon system, and a few weeks ago the Croydon Council woke up to the fact that the Act of 1903 authorising the extension to Penge also stipulated that the B.E.T. Co. should have the right of renting this portion of the line, as well as the other portion of the Croydon system. But the lease of the company expires in May next, and as the Croydon Council has decided to give the company the required six months' notice to terminate the lease, it was felt that this portion of the line should be completed in time to lease it to the company and also determine the lease with that of the other portion. This is the stretch which joins up the Penge line to the Croydon system.

At its last meeting the Beckenham Council received a letter from the B.E.T. Co. stating that that company would require the Council to supply electricity for the Penge tramways at the end of three months, according to the option which this Council holds by agreement with the company. The letter also stated that the company would not be prepared to pay the price of twopence per unit as asked for by the Council, and the Council has now decided that the matter shall be referred to the B. of T. for arbitration.

West Ham.—The Corporation agreed on Tuesday that the price of energy supplied for tramway purposes during the half-year ending March last be left at the figure provisionally settled, viz., 1·6d. per unit; that the price for the half-year ending the 30th ult. be 1·5d. per unit, and that the price on and after the 1st inst. be 1d. per unit. The electricity department is to pay to the tramways department the distribution cost per unit, calculated on the low-tension feeder basis, on all its sales of energy to its own consumers supplied through tramway feeders.

Willesden.—At the U.D.C. meeting on Tuesday, it was announced that a Committee of the Middlesex County Council was arranging an interview with the L.C.C. in regard to a proposal to reintroduce the scheme for constructing a tramway from Cricklewood to Bridge Street.

Woodford.—The P.C. has asked the Cheshire C.C. to oppose "to its utmost" the electric tramway scheme proposed for the district, on the grounds that tramcars would be detrimental in every shape and form, and would ultimately tend to increase the rates.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—The House of Representatives have passed a Bill for the construction of a telephone line between Sydney and Melbourne at an estimated cost of £30,000.

Post Office Telephones.—It is no doubt unavoidable that delay should often be incurred in obtaining connection with the telephone system, and though we do not approve of delay, we do not usually notice the complaints of would-be subscribers. The following letter, however, which appeared in the *Times* of October 19th, is somewhat amusing:—

"Sir,—May I venture to ask a small portion of your valuable space to call attention to the curious lines upon which the telephone business of the Post Office is conducted? For upwards of 2½ years I and my neighbours at Worcester Park have been endeavouring to obtain a connection with the Post Office telephone service, and there has been considerable correspondence, with which I will not trouble you; but on July 30th I wrote again asking when we might hope to get a connection, and was informed on August 2nd that 'the inquiries which it has been found necessary to make are not yet finished, but that no time shall be lost in completing them and acquainting you with the result.'

"Hearing no more, I wrote again on September 9th, asking whether the inquiries had been completed, and received a reply 'that the inquiries which it has been found necessary to make are not yet completed. The matter shall, however, be expedited, and a reply sent as soon as possible.'

"This, though very like the letter of August 2nd, would possibly have kept me from pressing too urgently for a reply, but on September 18th the Post Office, of their own accord, wrote to me saying that 'I regret that no trace of previous correspondence with you can be found in this office. In the circumstances, may I ask that you will be so good as to let me know the nature of your former inquiry?' I replied by quoting the words and dates of their previous letters, and explained that my object was to obtain connection with the Post Office telephone service for my neighbours and myself.

"This letter was not even acknowledged, so on October 2nd I wrote again to call the attention of the Post Office to the matter, and received a printed formal acknowledgement. I waited a week and wrote again, and received another printed acknowledgement.

"These facts, I think, speak for themselves.

I am, Sir, yours faithfully,

"James Ward Burchell.

"Copthorne, Worcester Park, Surrey,
"*October* 12*th*."

River Thames.—At the meeting of the Thames Conservancy on Monday, a letter was received from the secretary of the General Post Office, stating that a cable under the river bed from Twickenham to Eel Pie Island would not be satisfactory, as there was a considerable flow and scour at this point; and that, owing to a misunderstanding on the part of the local officer, two telephone wires had been placed over the river there. He asked that the same be allowed to remain. The application was granted, subject to the wires being maintained at a height of not less than 60 ft. above high water mark.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	
Closed { Port Arthur-Chifu	Mar. 9, 1904	
Jamaica-Colon	Jan. 5, 1905	
Cadiz-Tenerif	July 20, 1905	
Cotonon-Grand Bassam	Oct. 4, 1905	
Landlines.		
Puerto-Barrios	July 28, 1902	
Kertch-Soutehoum	Sept. 27, 1904	
Communication with Brazil *via* Galveston	July 18, 1905	

Wireless Telegraphy.—The Marconi Wireless Telegraph Co. has decided to erect a large station on the west coast of Ireland. It is hoped, by constructing a new station covering a larger area and of greater altitude, to obtain more satisfactory results.

Durban.—A Natal contemporary reports that Mr. John E. Neale, A.M.I.E.E., late principal of the Electrical Engineering Department, Goldsmith's Technical College, London, who has gone to Natal in connection with the proposed technical college, has been in communication with the Government in respect of an experiment he purposes carrying out forthwith in wireless telegraphy between the Durban Town Hall tower and the Bluff signal station, and has received written authority to proceed with it.

In the course of the experiments by the U.S. Government at Newport, R.I., wireless messages were received at the rate of 18 words a minute from a number of different stations simultaneously, including Cape Henry, which is 350 miles away.

The *Marine Journal*, of New York, reports that wireless telegraphy is being successfully used on vessels of the Atlantic fishing fleet for the purpose of locating good fishing grounds.

Indian Engineering states that it is intended to open at once to public traffic the wireless telegraph system between Burma and the Andaman Island.

A new station for wireless telegraphy, according to the *Neue Freie Presse*, is being installed at Norddeich, in Germany, on the North Sea coast. The area covered by its operations will have a radius of over 900 miles, and will include Germany, Austria, Switzerland, France, Great Britain, and Denmark, as well as the greater part of Italy, Sweden and Norway, and portions of Spain, the Balkan peninsula, and Russia. The station is being equipped with the Telefunken system by the Wireless Telegraphy Co., of Berlin, and will have towers nearly 60 yds. high. It is expected to be in working order early in the coming year.

Owing to an agitation in a section of the Italian Press, against the agreement between the Government and Mr. Marconi, which granted a monopoly to his system in Italy for 14 years, Mr. Marconi offered to cancel the agreement. The Government, however, refused to consent to this course.

CONTRACTS OPEN AND CLOSED.

OPEN.

Belfast.—November 3rd. The Scottish Temperance Assurance Company, Belfast, are inviting tenders for electric lighting and fittings in their buildings. Specification on application to Mr. John Woodside, A.M.I.E.E., Ocean Buildings, Belfast.

Belgium.—October 30th. The municipal authorities of Feluy (Hainaut) are inviting tenders for the concession for the electric lighting of the town.

Bridlington.—November 1st. One 200-kw. steam dynamo, pipework and switchboard extensions for the Corporation. See "Official Notices" October 6th.

Bristol.—The city electrical engineer invites tenders for an electric overhead travelling crane.

Cheshire.—November 3rd. Altrincham and Bowdon Administrative Sub-Committee for Education invite tenders for the electric wiring and fittings required for the Stamford Park New Council Schools. Plans and specification (deposit £2 2s.) from Jos. Howarth, Clerk to the Committee, Education Offices, Market Street, Altrincham.

Clacton-on-Sea.—November 6th. Gas engines and dynamos, switchboard, mains, battery, meters, crane, and buildings for electricity works, for the U.D.C. See "Official Notices" October 20th.

Gignac.—The Mayor and Mr. Aroles, 2, Passage David Belugon, Montpellier, are prepared to receive offers for the contract for providing this town with electric light.

London.—October 31st. The Metropolitan Asylums Board invites tenders for certain engineers' tools and workshop appliances, and a two-phase electric motor, at the Western Fever Hospital, Seagrave Road, Fulham, S.W. Specification, &c., at the Office of the Board, Embankment, London, upon payment of a deposit of £1.

Shoreditch.—November 7th. Water-tube boiler, superheater, piping, steel flue, &c., for the Electricity Department. See "Official Notices" to-day.

Stoke-upon-Trent.—November 1st. Re-wiring portion of the Workhouse and Cottage Homes, and replating the battery, for the Guardians. See "Official Notices" October 13th.

Spain.—November 27th. The Spanish Ministry of Public Works is inviting tenders until November 27th, for the construction of an electric tramway in Madrid, from the Ronda de Valencia to the Glorieta del Puente de Toledo. Particulars may be obtained from, and tenders are to be sent to, La Direccion General de Obras Publicas, Madrid.

Tynemouth.—November 2nd. One 165-kw. traction dynamo for the Corporation. See "Official Notices" October 13th.

CLOSED.

Burslem. — The Corporation Markets Committee has received the following tenders for the lighting of the General Markets by arc lamps:—

Cross & Cross, Walsall	£82 0 0
E. M. Evans, Manchester	104 17 0
David Wilson & Co., Huddersfield	133 13 0
Hooper, Neary & Co., London	146 0 0
Wainford, Froggatt & Francis, Stoke	152 0 0
Blackburn, Starling & Co., Hanley	194 0 0

The engineer's estimate was £95 10s.

Durban.—Tenders for 4½ miles of single track tramrails and accessories were invited from eleven firms and nine tenders were submitted ranging from £5,328 to £4,084, and the Committee directed the acceptance of Messrs. Hubert Davies and Spain's tender, for £4,528 17s. 3d.

France.—The French Post and Telegraph authorities in Paris have just given out orders as follows:—M. Marcellot, of Eurville (Haute Marne), 100 tons of galvanised iron wire, 4 mm. diameter, at 304½ fr. per ton; and Les Forges et Trefileries de Creil, of Creil (Oise), 90 tons ditto, at 304 fr.

Glasgow.—The Electricity Committee has accepted the offers by Messrs. Stewarts & Lloyds for the supply of lap-welded w.i. tubes for the Port Dundas station, at £72 10s.; and has recommended for acceptance the following tenders in connection with the various works required at Waterloo Street station:—

Messrs. Gregory & Co., for excavator, mason and brick works, amounting to £2,146.
Messrs. George Laird & Son, for carpenter, joiner and glazier works, £1,209.
Messrs. Bladen & Co., Ltd., for cast-iron and steel works, £1,694.
Messrs. Peter White & Co., for slater work, £88.
Messrs. Moses Speirs & Co., for plumber work, £317.
John Drummond, for plaster work, £1,323.
Peter M'Kerracher, for painter work, £142.
Messrs. R. Waygood & Co., for electric hoist, £382 10s.

These were the lowest offers, with the exception of that for the electric hoist. The total of the offers accepted is £7,302.

The Tramways Committee has accepted the following offers:—

Special track work, Albert Road, The Lorain Steel Co.
Bitumen, Craig Sharp, Ltd.
Rock asphalte, Currie & Co., Ltd.
Conduit for cable, The Howard Conduit Co.
Radiators for Clothing Department, J. Boyd & Sons.
Smithy fires, anvils, &c., Dempster, Moore & Co.
Cold Saws, Spear & Jackson.

Halifax.—The tender of the Chloride Electrical Storage Co., Ltd., for the supply of 12 C.W.8 type cells for storage battery, for £87 17s., has been accepted by the Corporation.

London.—The City Corporation has accepted the tender of Messrs. Lund Bros. & Co., at £4,190, for installing the electric light in the Foreign Cattle Market, Deptford. It has also placed an order for 1,000 electric glow lamps with the British Thomson-Houston Co., at £40.

L.C.C.—The Highways Committee of the L.C.C. has considered the following tenders for the supply of low-tension cables and the laying of ducts in connection with the equipment of the through tramways between the Strand and the Angel, Islington:—

1.—Low-Tension Cable.

Callender's Cable and Construction Co.	(accepted)	£4,025
British Insulated and Helsby Cables		4,068
Siemens Bros. & Co.		4,094
Anchor Cable Co.		4,141

2.—Laying of Ducts.

J. A. Ewart, London	(accepted)	£2,814
Reid Bros., London		2,974
British Insulated and Helsby Cables		2,992
John Mowlem & Co.		4,435

The tender of Messrs. Evered & Co., of Birmingham, has also been accepted, for a sum not exceeding £275, for the supply of the switchgear for the sub-station and as an extension, of an existing contract.

Pontypridd.—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for the equipment of the tramway from the town to Hafod, at £3,603, and that of Messrs. Henley's Telegraph Works Co. for cables, at £2,585.

Preston.—The tender of Mr. E. Dewhurst has been accepted, at £595, for installing the electric light in the new Isolation Hospital.

Southwark.—The B.C. has accepted the tender of Messrs. Spenser, Whatley & Co., Ltd, for the supply of 4,000 tons of West Hallam and Manners coal, at 12s. 7d. and 12s. 9d. per ton respectively, for the electricity works.

Walthamstow.—The U.D.C. has accepted the tender of the British Thomson-Houston Co. for the supply of motors for the tramway car-shed. It has also placed an order with Messrs. Frank Mortimer & Co. for a 10-h.p. motor, and with Messrs. Baughan and Co. for a 5-h.p. motor, both for hire-purchase.

West Ham.—The Corporation has received the following tenders:—

For 1,720 Yards ·034 Low-Tension Cable.

British Insulated and Helsby Cables ..	(accepted)	£73	2	0
Johnson & Phillips		84	6	0
Glover & Co.		78	5	6

For 1,640 Yards ·017 Low-Tension Single Cable.

British Insulated and Helsby Cables ..	(accepted)	£47	15	0
Johnson & Phillips		61	10	0
Glover & Co.		53	18	0

Wimbledon.—The U.D.C. has accepted the following tenders:—

General Electric Co., Ltd., for the supply of a ten-way street lighting fuse-board for Quicks Road sub-station, at £6 17s. 6d.
British Thomson-Houston Co., Ltd., electrically-driven plant for Durnsford Road pumping station, £1,740.

FORTHCOMING EVENTS.

To-day's Events (Friday, October 27th).—At 6.30 p.m. Institution of Electrical Engineers (Glasgow). Fourth Annual Dinner at the Grosvenor Restaurant.
At 8 p.m. Junior Institution of Engineers. Annual General Meeting and First Meeting of the Incorporated Institution.
At 5 p.m. Physical Society. At the Royal College of Science. Dr. W. E. Sumpner on "The Theory of Phasemeters."

Tuesday, October 31st.—Tramways and Light Railways Association. Visit to Brimsdown power station and sub-stations of the North Metropolitan E.P. Supply Co., and the Metropolitan Electric Tramways system. Train at Liverpool Street at 1.23 p.m.
Thursday, November 2nd.—At 8.15 p.m. Röntgen Society. At 20, Hanover Square. Prof. Wertheim-Salomonson on "The Ruhmkorff Coil."
At 8.30 p.m. Chemical Society. At Burlington House. Mr. P. Blackman on "The Molecular Conductivity of Water," and Mr. J. E. Purvis on "The Influence of very strong Electro-magnetic Fields on the Spark Spectra of Ruthenium, Rhodium and Palladium."
Friday, November 3rd.—At 8 p.m. Junior Institution of Engineers. Presidential Address by Mr. D. Clerk on "The Problem of the Gas Turbine."
Saturday, November 4th.—At 7.30 p.m. Glasgow Technical College Scientific Society. "Electric Power Plant Design," by Mr. P. D. Ionides.
Birmingham and District Electric Club. Mr. J. H. Stansbie on "Electric Furnaces."
Tuesday, November 7th.—At 8 p.m. Institution of Civil Engineers. Inaugural Address by the President, Sir Alexander R. Binnie. Presentation of the Council's Awards, and Reception in the Library.
During November.—Tramways and Light Railways Association. Lecture on "The Paving of Roadways." Visit to Holborn and Strand Subway.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, October 30th.—"A" Company, meeting of Officers and N.C.O.'s at 8 p.m.
Thursday, November 2nd.—"C" Company, technical instruction at 6 p.m.
Friday, November 3rd.—"D" Company, technical instruction at 6 p.m.

J. H. S. Phillips, Captain E.E.
For O.C.E.E.R.E. (V.)

NOTES.

The Fire at Bridgewater House: Not Caused Electrically.—As usual, in the case of a fire whose origin is not easy to determine, a suggestion was circulated that in this instance the electric wires were the cause. At Bridgewater House last week a conference was held, with the concurrence of the Commercial Union Fire Office, attended by Lord Ellesmere's secretary, Mr. Phipps, the consulting electrical engineers, Messrs. O'Gorman and Cozens-Hardy, represented by Mr. O'Gorman, and Messrs. Hancock & Rixon, to whom the electrical wiring had been entrusted. It appeared that internally insulated screwed steel conduit had been used, that there was absolutely no damage to the steel conduit, that there had been no arcing, and no wires melted inside the conduit, and that the roasting given to the rubber had been caused by external heat. It was agreed that electricity could not have been the cause. On the other hand, a lead gaspipe which was found in a partially melted condition near the fireplace is thought to have been the probable offender. A minute gas leak occurring near a ventilating duct, which was also discovered in the floor, would cause no smell of gas, but if ignited, would slowly melt an ever-increasing hole in the lead tube, and eventually a full blast of lighted gas playing on the timbers would easily account for the fire.

Smoke Abatement.—The question of finding some practical means for abating the nuisance caused by smoke will be discussed by members of the Royal Sanitary Institute and the Coal Smoke Abatement Society at a conference to be held in December next in the Royal Horticultural Society's new hall, under the presidency of Sir Oliver Lodge. The sections of the conference to consider domestic smoke abatement, factory and trade smoke abatement, and the administration, legislation and necessary reforms, will be presided over by Sir George Livesay, Sir William Preece and Sir William Richmond. The municipal authorities throughout the kingdom have been invited to send delegates. In connection with the conference, the Royal Sanitary Institute are arranging an exhibition of smoke abatement appliances, and the classification of exhibits includes heating and cooking appliances by gas or electricity, grates, stoves, mechanical stokers and fuel economisers, and other trade and municipal appliances for the prevention of smoke. It is the endeavour of the Institute to bring before the members of the conference the existing measures that are taken to lessen the smoke nuisance, and also the alternatives to the use of solid fuels in the home as well as the factory.

Tramcar Building in Manchester.—The Corporation of Manchester is about to undertake the building of tramcars required for future use on its system, and has just completed works for that purpose in Hyde Road, on a site 4 acres in extent. The workshops are divided into two main sections by an avenue running along their whole length, and this avenue is traversed by a 15-ton travelling crane capable of conveying a complete car from one shed to another. The works comprise 12 departments, with

manager's office, and will give employment to 250 artisans. It is intended that all future work in the way of repair and maintenance, as well as the construction of new cars, shall be carried out here. At the present time covers are being made for 100 of the large bogie cars used on the longer routes. The works were formally opened on Tuesday by the Lord Mayor (Sir Thomas Shann), in the presence of the members of the Tramways Committee and a number of guests. It is claimed that the car works, now completed, are the most modern and best equipped of their kind in the country. Two and a half acres of the works are covered over, and about one acre has glass roofs. The whole of the machines in use are electrically driven, the motors and shafting for the wood-working shops being in the basement. Special precautions are taken against the possibility of fire; there is an installation of 1,200 Grinnell automatic sprinklers, fed with water from the street mains and from a reserve tank of 7,500 gallons capacity in a tower. The total cost of the car works has been £54,800, and they have been built to the design of Mr. John Gibbons, architect, of Manchester. The contracts for their construction have been carried out under his supervision.

Fire Alarms in New York.—A recent official investigation shows that the fire alarm equipment of New York City is practically worn out, and it is recommended to put in an entirely new plant at an estimated cost of £320,000.

Appointments Vacant.—Assistant lecturer and demonstrator in electrical engineering for University of Leeds (£175); two postal and telegraph inspectors and one mechanician for the Postal and Telegraph Department in Northern Nigeria (£250); general manager for the Gloucester Corporation light railways; shift engineer for Croydon (£2).

The Simplon Tunnel.—The *Standard* says that the whole of the brickwork in No. 1 shaft of the Simplon Tunnel has been completed. The tunnel itself is thus finished, and only the permanent way and the telegraph and telephone cables have now to be laid.

Electric Shock Fatalities.—In Edinburgh Sheriff Court on 18th inst., a public inquiry was held respecting a fatality at the Lothian Coal Co.'s Lady Victoria Pit, which resulted in the death of a young man named William Naismyth Reid, a dockfooter. The evidence showed that the deceased touched a steel girder, with which an electric lighting cable had, through the burning off of the insulation, come into contact. There was also a piece of wood to keep the wire off the girder, but this had been shifted along a little—how, there was no information. Coming in contact with the wire, the man received a shock of about 500 volts. It was stated that Reid, who was healthy enough, was a "fit victim" for a deadly shock, perspiring freely at the time, while the ground conditions were also "favourable."

At Lambeth on Saturday an inquest was held with reference to the death of Richard Bohme, aged 27 years, a gymnast, of Brixton, who died in St. Thomas's Hospital on the previous Tuesday. Robert Hanlon, jun., said that on Thursday, October 5th, they had been practising in the ball room at the Loughborough Arms, Brixton, using a pole erected on a table, and held in position by steel wires fixed to the floor. They had had occasion to hang up some electric lights suspended from the ceiling, and as the room was wanted for a concert in the evening, the proprietor asked them to replace the lights. Witness was supposed to do it, but Bohme climbed up the pole, and was holding one of the steel wires with one hand, while the other rested on an electric light bracket. The moment he touched the bracket he had a 220-volt shock, and he shouted out that he could not let go. Witness at once went up the pole, and with great difficulty severed the wire. Bohme released his hold and fell a distance of 20 ft., his back striking the edge of the table. Mr. Richard J. Thompson, house surgeon at St. Thomas's Hospital, said deceased was completely paralysed below the level of the fourth rib, the result of a fracture of the first dorsal vertebra. He died from pneumonia following the injury. The jury returned a verdict of "Accidental Death."

Gas v. Electricity.—Croydon.—At Monday's meeting of the County Council the discussion as to the respective merits of gas and electricity as a street illuminant was resumed. In connection with an extension of the tramways, the Lighting Committee recommended that Mitcham road should be lighted by 32 magazine flame arc lamps, at an estimated cost of £882. In moving the report, it was pointed out that these lamps would cost £12 10s. per annum as compared with £15 for high-pressure gas lamps charged in the City. The recommendation was carried.

Exeter.—A long report of the conference between the Electric Committee and the Committee having charge of the lighting of the streets of Exeter was presented this week to the City Council. There are 42½ miles of streets and thoroughfares in the city. Two miles of streets only are lighted by electricity. The cost of electric light is £800, and the cost of gas lighting £4,210. The lighting of the whole of the streets by electricity would necessitate the laying of at least one cable in 27½ miles of streets and the fitting and connecting up of 1,014 lamps. The cost of the cable for street lighting only would be £220 per mile, and the average cost of fittings and connections for the lamps, £3 10s. per lamp. This would entail a capital outlay of £10,381, and the annual cost of the additional lamps would be £4,831. If the cables were laid so as to provide for private lighting as well as the lamps, that would mean a further capital outlay of £6,050. A Sub-committee is to inquire further into the question, and the gas company are to be asked to submit a scheme for lighting the streets outside the tramway routes.

Institution Notes.—Leeds University Engineering Society.—Prof. Goodman presided over the opening meeting of the session of this society, and Mr. W. H. Casmey brought forward the subject of "Induced Draught to Steam Boilers." He contended that in induced draught lies, to a large extent, the remedy for the loss and annoyance caused by the smoke nuisance. He proceeded to show theoretically that this method is an improvement on natural draught or forced draught by means of steam jets. He claimed the advantages of smaller coal consumption, increased boiler capacity, and positively decreased cost, giving figures and diagrams obtained from actual experience in support of his statements. In addition, he urged the indirect benefits of greater cleanliness, absence of fogs, with consequent unimpeded street traffic, and decreased cost of general lighting, and generally improved conditions of the animal and vegetable kingdoms. In the course of the discussion that followed the paper, a strong point was made of the short life of the fans, but Mr. Casmey affirmed he knew of fans which had been running seven years, and showed no sign of breaking down.

Institution of Electrical Engineers.—The first London meeting of the session will be held on Thursday, November 9th, at 8 p.m., when Mr. John Gavey, C.B., will deliver his inaugural address. The premiums awarded for papers read or published during the last session will be presented at this meeting.

Tramways and Light Railways Association.—On Wednesday evening, at the Society of Arts rooms, Mr. T. W. How, F.R.G.S., read a paper on "Roller Bearings," with special reference to their application to tramway and railway rolling stock, and other forms of motion. Mr. A. L. C. Fell was in the chair. The author, after describing the technical requirements of a satisfactory roller bearing as applied to heavy loads, gave some interesting and conclusive examples of the successful application of roller bearings as the result of recent and independent tests, and showed that at Wolverhampton and Croydon, where tests for savings in current consumption had been exhaustively made, at least 15 per cent. of electrical current was saved, equal to £37 14s. per car per annum. He also gave the results of the latest test trials made regarding savings in coal consumption on the train now running in regular suburban service on the London, Brighton and South Coast Railway, which showed that an economy of 15 per cent. was obtained, calculated on the drawbar pull of the seven bogie coaches; this being equivalent to an annual saving of £85 per train per annum. Other favourable examples were given, and the author claimed that extended experience had now amply proved that the efficiency and durability of roller bearings, when constructed upon proper principles, were now fully assured, whether they were applied to railway or tramway rolling stock, or to other fixed or movable machinery; and that their adoption was a necessity in all cases where cheap power was required, or where existing power stations or rotary machinery were working up to their full limit and had not room for expansion. The lecture was fully illustrated by lantern slides.

I.E.E.—*Leeds Local Section.*—At a meeting held on Wednesday, Mr. T. Harding Churton read a paper on "Notes on Alternate Current Induction Motors."

At the City of Bradford Technical College on Monday evening, October 16th, Mr. W. H. Roy lectured on "Modern Condensing and Water Cooling Plant," with special reference to high vacuum.

Before the English Ceramic Society at Stoke last Saturday week, Mr. Axel S. W. Odelberg, a Swedish potter, lectured on "The Application of Electricity to Potter's Machinery." Mr. C. H. Yeaman, the borough electrical engineer of Hanley, took part in the discussion.

Accident.—On Tuesday evening last week, a foreman electrician named Wood, engaged by the Priestman Electrical Power Co., of Blaydon Burn, whilst engaged in examining a switchboard connected with the electric light installation at the Blaydon sidings of the N.E.R., came in contact with a "live" wire, with the result that he sustained severe burns about the body, part of his clothes being also burnt.

London County Council.—At the meeting on Tuesday last week, it was decided to lend £1,874 to the St. Pancras B.C. for mains, machinery and meters, and £16,275 to the Woolwich B.C. for the laying of mains over a route of 10 miles.

The Fire Brigade Committee reminded the Council of the recent determination of a contract with a firm for the wiring of the Wapping station, as the firm had asked to be relieved of its obligations. It was then decided to make other arrangements, but the next lowest tenderer intimated that he was unable to execute the work except at an advance of 25 per cent. on the amount of his tender. The third lowest offer, which amounted to £130, was submitted by Barlow & Young, and the Committee stated that it had accepted the tender, as the firm were willing to carry out the work for that sum.

The Highways Committee stated that when the Greenwich power station was finished, the use of the temporary stations at Deptford, Loughborough Junction and Bankside would be discontinued. The feeder cables between the Elephant and Castle sub-station and Deptford would be utilised for the permanent supply from Greenwich, but it would be necessary to supplement those cables by the provision of additional feeders. A report would be presented with regard to the tenders for the supply of high and low tension cables for the tramways in Battersea, Wandsworth and Lewisham, and the Committee proposed to make arrangements with the firm whose tender should be accepted for the high tension cables also to supply the additional cables referred to, the cost of which was estimated at £5,300.

The question of making application to Parliament on behalf of the Borough Councils in regard to the wiring of consumers' premises, was also referred to by the Highways Committee. In the 1905 session

the proposal was rejected by the House of Lords, but as several of the Borough Councils had asked the County Council to revive the scheme in the session of 1906, the Committee submitted a recommendation in favour of making a fresh application to Parliament to authorise the wiring and fitting of premises by the borough electric lighting stations, and for the local authorities to obtain loans for this purpose.

The Highways Committee further submitted a report respecting the Oxford Street station of the Charing Cross, Euston and Hampstead Railway.

Gas.—An escape of gas at Shakespeare Mill, Blackburn, on Monday, became so serious that several weavers were rendered unconscious. About 20 weavers were affected, and work had to be stopped.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—On 19th inst. Mr. S. Wotzkow, meter fixer, &c., was presented by Mr. A. H. Shaw, electrical engineer, on behalf of the staff of the Ilford Electricity Works, with a handsome timepiece on his resigning to take up a better appointment in West Africa.

The Southend T.C. has appointed Mr. H. K. Rowe, switchboard attendant, as shift engineer at the Electricity Works.

The Hoylake and West Kirby U.D.C. has deferred for a year the question of increasing the salary of the electrical engineer (Mr. H. G. MacHaffie). The Council had been recommended to grant an increase from £285 to £310.

The Halifax T.C. has increased the salary of Mr. E. Hollas, charge engineer at the Electricity Works, from £104 to £118.

General.—Mr. James K. Bock sailed last week for Havana, *via* New York, to take charge of the Havana Electricity Co. for six or nine months, to organise the same commercially and technically on behalf of the London board of directors.

Mr. E. S. Atkinson Smith, of Bridlington, has been appointed by the Battersea Borough Council canvasser for consumers of electrical energy, at a salary of £2 a week, and commission. There were 71 candidates.

Mr. B. Sherman has resigned his directorship of the Amalgamated Dry Batteries, Ltd., 16—17, Devonshire Square, E.C., and Mr. F. Heron Rogers has been elected in his place.

Mr. E. Trenam, I.P.O., Controller of the Central Telegraph Office, St. Martin's-le-Grand, is about to retire on pension. He has seen a lengthy service. He was appointed traffic manager in the Secretary's Office in 1900, Deputy Controller in 1901, becoming Controller of the Central Telegraph Office in 1902.

Mr. Richard Jones, late manager of the Electric Construction Works at Bushbury, near Wolverhampton, was honoured on Saturday evening, when, on his retirement, he was entertained to dinner at the Victoria Hotel by 60 of the officers and employés of the company, with which Mr. Jones has been connected a quarter of a century. Mr. Jones was also the recipient of a marble timepiece, a pair of bronzes and a purse of gold. The meeting was presided over by Mr. Wm. Bullock, and the presentation was made by Mr. Moore on behalf of his colleagues. Mr. Jones appropriately acknowledged the gifts.

Obituary.—Mr. Chas. Radcliffe Thursby, M.I.C.E., who had been connected as resident engineer and manager with various tramway and electric light and power concerns in Argentine and Brazil, and is described as "the pioneer of electric traction in Buenos Ayres," died on August 28th. He sailed from Liverpool on August 19th with his wife to winter in the Southern States of North America, but he was in such a weak state that he had to be landed at Queenstown, where he died on the date mentioned. An illustrated obituary notice appeared in the *Review of the River Plate* for September 29th.

NEW COMPANIES REGISTERED.

International Electric Railways and Water-Power Syndicate, Ltd. (86,215).—This company was registered on October 21st, with a capital of £120,000 in £20 shares, to acquire concessions, rights, powers, or privileges relating to the construction of, and to construct, maintain, work and use, railways or tramways adapted to electric or other traction in any part of the world; to acquire lands and develop and turn to account the same by the erection of hotels and pensions, by the establishment of holiday resorts, and otherwise; to acquire rights of water-power, and to turn the same to account (*inter alia*) for the generation of electric power for traction, lighting and other purposes, both for the company's own use and for supply to others, and to carry on the business incidental or auxiliary to any of the above objects. The first subscribers (each with one share) are:—H. H. S. Scott, 94, Hope Street, Glasgow, shipbroker and commission agent; F. J. Rowan, 5, West Regent Street, Glasgow, consulting engineer; H. D. Lawrie, 94, Hope Street, Glasgow, shipbroker; A. R. Cunninghame, Conservative Club, Glasgow, petrol merchant; W. T. R. Shirrefs-Gordon, 70, Buchanan Street, Glasgow, motor-car agent; C. H. Murray, jun., 98, West George Street, Glasgow, stockbroker; J. G. Murray, Ardgour, Kilcreggan, N.B., gentleman; G. H. Borrer, Angeston Grange, Dursley, J.P. No initial public issue. The number of directors is not to be less than three nor more than eight; the subscribers are to appoint the first; qualification, £500; remuneration, £150 each per annum (£300 for the chairman) and 2½ per cent. of the distributed profits divisible.

London Outer Circle Railway Syndicate, Ltd. (86,165).—This company was registered on October 17th with a capital of £20,125, in 20,000 "A" shares of £1 each and 2,500 "B" shares of 1s. each, to promote a company for the construction and working in the counties of London, Middlesex, Hertfordshire and Essex, or elsewhere, of a railway or railways for the carrying of passengers, minerals and goods by means of steam or electric traction, or otherwise, and to apply for a special Act of Parliament relating thereto. The first subscribers (each with one "B" share) are:—E. Eacott, 29, Powell Road, Clapton, N.E., gentleman; S. Jordan, 115, Elm Park Mansions, Chelsea, S.W., gentleman; P. F. Lucas, 32, Upper Gloucester Place, N.W., gentleman; H. St. J. Browne, the Court House, Kingsthorpe, Northampton, gentleman; C. T. Lissenden, 24, Arica Road, Brockley, S.E., gentleman; W. J. McNelly, 15, Walter Street, Stepney, E., gentleman; and P. R. Reeves, 186, Chamberlayne Wood Road, Kensal Rise, N.W., shorthand writer. No initial public issue. The number of directors is not to be less than three nor more than five. The first are:—H. K. Rutherford, the Hon. Arthur C. Ponsonby, R. H. Cox, W. B. Cownie and C. Rozanrand. Remuneration, £50 each per annum (chairman, £100). The "A" shares carry a cumulative preferential dividend of 5 per cent., the residue of the net profits going to the "B" shares. The "A" shares have preference in any return of capital. The holders of the "A" shares shall not be entitled to vote on any resolution for reducing the capital by cancelling all the 20,000 "A" shares upon the terms that the company shall pay to the holders the full amount thereof, together with such sum as, with the aggregate amount of dividends paid thereon, up to the time of cancellation, shall be equal to interest at 5 per cent. per annum from the date of issue to the date of cancellation. Subject, as aforesaid, every share shall confer one vote. No further "B" shares may be issued without the consent of the holders of the "B" shares numbered 2,001 to 2,500 inclusive, but subject to this provision the company may be increased with the sanction of separate meetings of the "A" and "B" shareholders. Registered office, 266 and 267, Salisbury House, London Wall, E.C.

Diamond Electric Lamp, Ltd. (86,201).—This company was registered on October 20th, with a capital of £20,000 in 12,000 15 per cent. cumulative preference shares of £1 each, and 32,000 deferred shares of 5s. each, to adopt an agreement with H. Diamant and A. Chiesa, and to carry on the business of manufacturers of and dealers in arc lamps, electricians, mechanical and electrical engineers, manufacturers and suppliers of electricity for light, heat, motive power or otherwise, &c. The first subscribers (each with one share) are:—W. H. Greedus, 12, Cottage Street, Poplar, E., warehouseman; F. J. Cole, 37, Patriot Square, Cambridge Heath, E., stationer; J. Fowler, 41, Meanley Road, Manor Park, E., engineer; E. G. Pharo, 147, Leahurst Road, Lewisham, S.E., cabinet maker; E. W. Dannell, 264, Hanover Buildings, Tooley Street, S.E., printer; F. Griffiths, 96, Westcombe Hill, Blackheath, S.E., agent; and F. Sidney, 98, Sewardstone Road, Victoria Park, N.E., clerk. No initial public issue. The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first; qualification, £100 (the articles provide that shares represented by warrants shall be reckoned in the qualification of a director); remuneration, £100 each per annum (chairman, £125), and 5 per cent. of the net profits after 15 per cent. dividend has been paid, divisible.

Light Railways Co. of Sicily, Ltd. (86,207).—This company was registered on October 20th, with a capital of £12,000 in £1 shares, to acquire any railways or tramways, electric lighting works, plant and machinery in Sicily or other part of Italy or elsewhere, and to carry on the business of railway and tramway proprietors, carriers of passengers and goods, electrical, mechanical and hydraulic engineers, electricians, manufacturers of and dealers in railway, tramway, electric, magnetic, galvanic and other apparatus, transmitters, users and suppliers of light, heat, sound and power, &c. The first subscribers (each with one share) are:—A. Roddick, 4, Adelphi Terrace, W.C., surveyor; R. G. Trollope, West Halkin Street, S.W., estate agent; E. W. Shackle, 14, Mount Street, W., surveyor; A. J. Lawson, 4, Adelphi Terrace, W.C., civil engineer; A. R. Allen-Lodge, 7, Fielding Road, Bedford Park, W., architect; G. Waterhouse, Park House, Buckhurst Hill, architect's assistant; and W. Webb, 22, Cathcart Hill, N., clerk. No initial public issue. The number of directors is not to be less than two nor more than five, the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company.

A. W. Penrose & Co., Ltd. (86,209).—This company was registered on October 21st, with a capital of £40,000 in £1 shares (10,000 6 per cent. cumulative preference), to acquire the business carried on by A. W. Penrose & Co., at 109, Farringdon Road, E.C., to adopt an agreement with A. W. Penrose, and to carry on the business of manufacturers of and dealers in all machinery, apparatus, material and appliances used in connection with photography, etching, engraving, drawing, painting, printing or other graphic arts, electrical and general engineers, makers of arc and incandescent lights, manufacturers of electric cranes and hoists, makers of printing machine motors and gears, and electro-typing and electro-plating plant, &c. The first subscribers (each with one share) are:—A. W. Penrose, 5o, Portman Mansions, W., manufacturer; T. E. Baker, 16, Serjeants' Inn, Fleet Street, E.C., solicitor; E. C. Myring, 14, Regent Street, S.W., secretary; H. W. Grant, 13, Tintern Street, Clapham, S.W., cashier; A. E. Boshier, 104, Falkland Road, Hornsey, N., clerk; J. Camp, 14, Serjeants' Inn, Fleet Street, E.C., registration agent; and A. E. Reed, 15, Palace Road, Crouch End, N., clerk. No initial public issue. The number of directors is not to be less than three nor more than five; the first are A. W. Penrose, W. Gamble and D. Munro. A. W. Penrose is governing director, and may retain office while holding 5,000 shares, with power to appoint other directors. D. Munro is nominated by the Law Guarantee and Trust Society, Ltd.; qualification (except above-named directors and other directors nominated by the said society), £100; remuneration of A. W. Penrose, £600 per annum. So long as the guarantee of debentures by the Law Guarantee and Trust Society, Ltd., remains in force, the total remuneration of directors (including governing director) shall not, without the consent of the said society, exceed £1,000 per annum. Registered office, 109, Farringdon Road, E.C.

Electrical Instrument Manufacturers, Ltd. (86,187).—This company was registered on October 19th, with a capital of £5,000 in £1 shares (100 founders') to carry on the business of electrical engineers, contractors, tool and instrument makers, cable manufacturers and layers, electricians and the like, and with a view thereto to enter into an agreement between T. Ward of the one part, and H. G. Matthews of the other part. The first subscribers (each with one share) are:—H. G. Matthews, High Street, Stevenage, clerk; C. J. Burchall, Enfield Highway, N., photographer; W. Bugg, High Street, Cheshunt, veterinary surgeon; R. L. Bugg, High Street, Cheshunt, butcher; Mrs. C. E. Bugg, High Street, Cheshunt; T. Ward, 22, Totteridge Road, Enfield Wash, manager; and R. Goddard, 6, Bergholt Crescent, Amhurst Park, N., clerk. No initial public issue. The number of directors is not to be more than seven; the first are not named.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Exchange Telegraph Co., Ltd. (6,152).—The company's annual return was filed on September 12th, when 8,023 "A" and 16,200 "B" shares had been taken up, exclusive of forfeited shares, out of a nominal capital of £246,250 in 8,125 "A" and 16,500 "B" shares of £10 each; £9 per share has been called up on 6,000 "A" and £1 per share on 2,023 "A" shares, resulting in the receipt of £56,023, in addition to £816 paid in respect of forfeited shares; £179,000 is considered as paid, being £10 per share on 16,200 "B" and £8 per share on 2,125 "A," of which 102 have been forfeited. Mortgages and charges: Nil.

Electrical Oil Refining Co., Ltd. (43,126).—This company's annual return was filed on September 21st, when 4,375 shares had been taken up out of a nominal capital of £5,000 in £1 shares; £1 per share has been called up on 882 and £882 has been received; £3,493 is considered as paid on the remainder. Mortgages and charges: Nil.

Eastern and South-African Telegraph Co., Ltd. (13,306).—This company's annual return was filed on August 11th, when the entire capital of £600,000 in 60,000 shares of £10 each had been taken up and paid for in full. Mortgages and charges: £500,000.

Chloride Electrical Storage Co., Ltd. (35,389).—This company's annual return was filed on September 16th, when all the preference and ordinary shares had been taken up out of a nominal capital of £135,250 in 62,000 preference, 33,250 ordinary, and 40,000 unclassified shares of £1 each; £1 per share has been called up on 48,750 preference and 16,250 ordinary shares, resulting in the receipt of £65,000; 13,250 preference and 17,000 ordinary are considered as fully paid. Mortgages and charges: £20,000.

CITY NOTES.

Underground Electric Railways Co. of London.

The report for the twelve months ended June 30th, 1905, states that the works which are being carried out by the company on the Metropolitan District Railway, the Baker Street and Waterloo Railway, the Great Northern, Piccadilly and Brompton Railway, the Charing Cross, Euston and Hampstead Railway and the power house have made satisfactory progress since the last report. Electricity has been supplied from the power house at Chelsea through the transmission lines to Earl's Court, and thence through the District Co.'s own cables for the past six months, for the operation of that company's railway system. Five of the turbo-generators have been installed. The sub-stations for the operation of the District Railway are all completed and operating. The sub-stations for the Baker Street and Waterloo Railway are nearing completion, and the machinery is being installed. The sub-stations for the Great Northern, Piccadilly and Brompton Railway and the Charing Cross, Euston and Hampstead Railway are in course of erection, and the machinery is being manufactured. All work of construction on the Metropolitan District Railway has been finished. All of the lines have been opened for public traffic with electric trains. A few steam trains still continue to run during the rush hours, but they will be replaced by electrical trains before November 1st. A serious delay occurred in the delivery of the rolling stock which was contracted to be delivered during the months of November and December of last year. The balance of cars for this railway will be delivered this month. All electrical equipments for the cars have been received. The new car shops at Mill Hill Park, which have been equipped with the most modern and up-to-date appliances, are in full use, and it is expected that a very large saving in expenditure will result. The replacing of the old wooden station platforms with concrete platforms is a substantial improvement. All of the stations are now lighted with electricity, and the cleaning of the tunnels and the rearrangement of the advertisements is receiving the attention of the company. On the Baker Street and Waterloo Railway the construction of tunnels and shafts between Baker Street and Westminster Bridge Road has been completed. Lifts are being installed, and the tiling is nearly finished. The permanent way is completed, and the conductor rails are being bonded. The car and repair shops at St. George's Circus are finished and completely equipped. The electrical apparatus for all the trains has been delivered and is ready to be installed on the cars. A delay has occurred in the delivery of the rolling stock, which has to some extent retarded the opening of the line, but it is hoped that the line will be opened for public traffic during the month of March next. On the Great Northern, Piccadilly and Brompton Railway the tunneling has been completed between Finsbury Park and West Kensington, where the line comes to the surface, with the exception of the station tunnel at Holborn. The lift and stair shafts have been sunk at all but two of the stations, and the permanent way is being laid in the greater part of the tunnels; the tiling and general decorations of the underground stations are well advanced, and three of the surface station buildings are in course of construction, and contracts for three others have been let. The contractors are progressing satisfactorily with the installation of the lifts: the rolling stock has been ordered, and no delay in delivery is anticipated. It is hoped that this line will be opened for public traffic before the end of 1906. Work has been commenced on the section of the line between Holborn and the Strand, which has received Parliamentary sanction in the last session. The construction of this small section will not interfere with the opening of the main line. On the Charing Cross, Euston and Hampstead Railway the tunnelling is nearly completed. The lifts and stair shafts have been sunk at nearly all of the stations. An interchange station has been arranged with the London and North-Western and the City and South London Railway Companies at Euston. The rolling stock has all been ordered. It is hoped that this line will be opened for public traffic early in the year 1907. As regards the London United Tramways (1901), Ltd., good progress is being made by the company's contractors in the construction of the authorised tramways in Kingston, Surbiton, The Maldens, and between Brentford and Hanwell. These lines are expected to be completed during the present year, and will link up important centres of population, and connect with the company's main system of electric tramways in Middlesex and the London central area.

Mr. C. T. Yerkes presided at the meeting held at Hamilton House on Tuesday. He said that the report stated the affairs of the company very fully, and he had nothing to add except that since it was gotten up they had been making very rapid progress—more so than was their habit, and there were a number of matters which had just about come to the concluding point. Everything had been found to work as they wished it to. One thing that gave them a great deal of pleasure was that their estimates would not be exceeded, in fact, they would be inside them. That for the building of a large railroad properties was something they did not often meet. All of their machinery was working well, and they were glad to say that the District was increasing its receipts, and wherever they had electricity in full force there were splendid results. There were places where they still had to run steam, but that they would get through in a little while, and he was sure that their most anxious anticipations would be fully realised.

Various questions were put to the chairman. One shareholder asked if he could tell them anything about the actual working of the District trains. Was the board generally quite satisfied with the present traffic arrangements, more especially as to the division into classes? He thought the traffic would probably run much more evenly if there were only one class, as on the Central London. The Chairman, in reply, said that they were now making experiments. They were like a man going into business. They did not know what the first-class passengers were going to do. As it was now, he would say that experience had shown that they were giving 14 per cent. of space on the cars to 7 per cent. of passengers. That they were going to change. They had expected the first-class passengers would run down to almost nothing, but they had been mistaken in that. They did go down very low at first, but they had increased during the last three or four weeks, until they had now got to about 8 per cent. of the total amount travelled. Of course, they got more from the first than from the third-class passenger. All of this would be regulated in accordance with their experience. If they found that the people did not require the first-class cars, they would take them off. In regard to a reference to overcrowding, the Chairman said that it was to their advantage to do whatever the public wished. The more they pleased them the better.

Mr. Makins asked if the power station was giving every satisfaction, and he mentioned the smoke nuisance matter, about which there had been something in the papers.

The Chairman said that they would see more in the newspapers regarding the smoke nuisance than at the station itself. Chelsea was not in the habit of having tall chimneys and big engine power. They had reduced their smoke to the merest minimum, and if they saw photographs of those smoke stacks it would surprise them to see the small amount of smoke. They had the best apparatus that was made in the world. The power house was a complete success except for the noise, and that the Westinghouse Co. was now using every effort to do away with.

Lord Farrer seconded the adoption of the report, and it was carried.

The retiring directors and auditors having been re-elected, the meeting became extraordinary, and passed an alteration in the articles of association.

Eastern Extension, Australasia and China Telegraph Co.

The report for the half-year ended June 30th, 1905, states that the gross receipts during that period have amounted to £348,850, against £300,058 for the corresponding half-year of 1904. Working expenses, including £21,457 for maintenance of cables, absorb £135,950, against £141,707 for the corresponding period of 1904, leaving a balance of £212,900. From this is deducted £3,384 for income-tax, and £14,615 for interest, &c., on debenture stock, leaving £194,900 as net profit for the half-year. After adding £22,181 brought forward, there is an available balance of £217,081. Two quarterly interim dividends of 1¼ per cent. each, amounting to £75,000, have been paid for the half-year, leaving £142,881, of which £100,000 has been transferred to the general reserve fund, and the balance of £42,081 is carried forward. The tariff for telegrams transmitted between Japan and Europe by this company's route was reduced on July 1st last from 5s. 8d. to 4s. 10d. per word, making the rate the same as by the Great Northern Co.'s route *via* Russia.

Rosario Electric Co.

The report for the year ended June 30th last, states that the balance at credit of profit and loss account is £11,293, to which must be added the amount brought forward, £913, making a total of £12,206. The directors propose to allocate to amortisation of concessional rights £500; depreciation on buildings, plant and machinery, £1,981; and on tools, stores and furniture, £82; writing off half of the expenses of issue of 8,000 preference shares, £1,267; and after paying a dividend of 3s. per share on the ordinary shares there remains to be carried forward £2,667. The number of 8-c.p. lamps connected, including theatres (about 11,300 lamps), at June 30th, 1905, was 67,994. In view of the continued demand for lighting and power, the directors have ordered a fifth steam dynamo of 500-kw. capacity and accompanying boilers and accessories. The old station plant is still partially in use for serving the street lighting. It will be necessary to increase the capital of the company very shortly in order to meet the satisfactory expansion of business. Mr. Western, a director, is now in the Argentine Republic.

Richardsons, Westgarth & Co.

The report for the year ended August 25th, 1905, states that the profits shown in the accounts, after maintaining the buildings and machinery in a condition of thorough repair at a cost of £18,384, amount to £75,373, to which has to be added the balance brought

from the year to August 25th, 1904, £16,635—£92,008. The directors now recommend a balance dividend on the preference shares at the rate of 6 per cent. per annum and a dividend on the ordinary shares for the year at 6 per cent. per annum, setting aside for depreciation £15,000, placing to reserve account £10,000, and leaving to be carried forward £6,758. The new turbine works and new brass foundry at Hartlepool, new iron foundry at Middlesbrough, and the boiler-shop extension at Sunderland, are now completed and fully employed.

Anglo-Portuguese Telephone Co.

A circular has been issued to the share and debenture stockholders, in which it is stated that since the installation of the common battery system in Lisbon a great improvement in the service has taken place. The number of subscribers continues to increase. Three new exchanges, Caxias, Queluz and Cintra, have recently been established; the work of installing exchanges in Almada and Barreiro on the south side of the river has now been commenced; and the necessary permissions for laying the cable under the River Tagus to connect these places with the central office have been obtained from the authorities. In Oporto, the reconstruction of the system has been followed by a steady increase in the number of subscribers, and the future prospects in this place are also distinctly encouraging. The relations of the company with the Government authorities continue to be most satisfactory. The proposal of the company to establish telephonic communication with the south side of the River Tagus has been cordially received, as it supplies a want which has long been felt. The issue of £50,000 5 per cent. debenture stock sold to the Consolidated Electrical Co., Ltd., in April last, for £45,500 was all subsequently paid for on the due dates. The proceeds have been applied by this company to the redemption of all outstanding debentures of earlier date, the debt due to the contractors has also been discharged, and the balance (£10,162) has been invested temporarily in short date Colonial Government bonds, pending its requirement for the extension of the company's telephone system in Portugal.

Parsons Marine Steam Turbine Co.

The directors' report to June 30th states that since the last report many important orders for turbine engines have been executed by the company. Further orders have been received by the company for turbine engines, and are at present in progress, and a number of turbine engines are being manufactured under licence from the company by various firms. The company has disposed of its original shares in Parsons' Foreign Patents Co., Ltd., for a sum received in cash, and certain new shares which carry an interest, which the directors consider of considerable value. The accounts show a profit on manufacturing and from royalties, &c. (after providing for depreciation on buildings, plant, and machinery, and for experimental work and for renewal of plant, &c.), of £25,513. Adding the sum brought forward from the last balance-sheet, the amount available is £27,572. The directors recommend the payment of a dividend of 7½ per cent., free of income-tax (which, with the interim dividend of 2½ per cent. already paid, will make 10 per cent. for the year), carrying forward £6,772.

Western Telegraph Co.

The directors' report for the half-year ended June 30th, 1905, says that the revenue for this period amounted to £283,360, and the working expenses to £116,665. After providing £14,146 for debenture stock and debenture interest and sinking fund, and £5,137 for income-tax, there remains a balance of £147,412; to this is added the sum of £3,892 brought forward from December 31st last, making a total of £151,304. A quarterly interim dividend, amounting to £31,190 has been paid, £60,000 transferred to the general reserve fund, and £5,000 to the maintenance ships' reserve fund. The directors now recommend the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, and also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,983, leaving a balance of £3,132 to be carried forward. The dividend and bonus will be payable on November 2nd. It is with much regret that the directors have to announce the retirement of their esteemed colleague, Mr. W. S. Andrews, through ill-health. The Right Hon. Lord Balfour of Burleigh, K.T., has been elected a director to fill the vacancy thus occasioned on the board.

South Lancashire Electric Traction Co.

The *Financial Times* says that this company, which for some time has been in the hands of receivers for the debenture-holders, has recently assumed a new phase. The company's undertaking was advertised for sale and a date fixed for the receipt of tenders. On the day following this date a meeting of the debenture stockholders was called by the receivers to take their views upon the tenders received and to consider the position generally. At this meeting it was explained that two tenders only had been received for the property, and after considering the position generally, the debenture-holders present in person and by proxy asked the Court to accept the tender of the Hon. Arthur Stanley, M.P. (a large debenture-holder and a director of the company)—notwithstanding that the purchase price was below the reserve price fixed by the Court—for the assets covered by the debenture issue at the price of £150,000, upon Mr. Stanley undertaking to offer to the other debenture-holders, ratably to their respective holdings, the right of participating on the same basis as himself in any company which might be formed to take over the said assets or any other dealing which might be made therewith. The Hon. Arthur Stanley now proposes to form a new company, and has invited the debenture-holders, in accordance with his undertaking, to participate on the same basis as himself in this formation. It is stated that about 95 per cent. of the debenture-holders have responded, and agreed, to come in. The property consists of a light railway between Liverpool and Prescot and the South Lancashire tramways between St. Helens and Hindley, Atherton, Leigh, Bolton and Tyldesley, already constructed. The company has also powers for lines not yet constructed, which will connect the existing lines with Manchester, Bolton, Warrington, Newton-le-Willows and Earlestown.

Westminster Electric Supply Corporation.

A meeting of this corporation has been called for Tuesday next, at 11.30 o'clock, at Eccleston Place, to consider a proposal to increase the capital from £800,000 to £2,000,000. The resolutions to be submitted read as follows:—

1. That the capital of the company be increased from £800,000 to £2,000,000, by the creation of 240,000 new shares of £5 each, of which 90,000 shares be issued as ordinary shares, and 150,000 be issued as preference shares carrying a cumulative preferential dividend at the rate of 4½ per cent. per annum, and ranking *pari passu* with the 50,000 preference shares authorised by special resolution passed and confirmed on the 4th and 19th days of December, 1901, and that any preference shares thereby authorised and unissued shall be issued upon the terms of carrying dividend at the rate of 4½ per cent., instead of 5 per cent. per annum.
2. That the directors be and are hereby authorised at their discretion out of the balance of the reserve fund for the time being and the balance of revenue carried to the general balance-sheet as on December 31st, 1904, to divide between the holders of the preference shares issued prior to the date of this meeting, rateably in proportion to the amount paid on the preference shares held by them respectively, the sum of £15,640, free of income-tax.
3. That if the holders of preference shares consent to the reduction of the dividend thereon, 3,128 of the preference shares unissued be offered at par to the existing preference shareholders for subscription rateably in proportion to the number of preference shares held by them, on the terms that such 3,128 shares shall be paid up in full on allotment, out of the sum provided by the previous resolution, and carry a cumulative preferential dividend at the rate of 4½ per cent. instead of 5 per cent. per annum.

The object of the resolutions is to provide for the further capital that may be required from time to time during the remainder of the company's concession, which is estimated to amount to £1,000,000. The capital expenditure so far has been £1,085,000; the issued capital in ordinary and preference shares has been £690,755 plus £250,000 of debenture stock, making a total of £940,755. The proposal embodied in the above resolutions will ensure the raising of such new capital at a lower rate of interest.

Brunner, Mond & Co., Ltd.—The directors have declared a dividend on the ordinary shares for the past half-year at the rate of 35 per cent. per annum. The directors will propose to apply a portion of the reserve fund to paying a special dividend of 33⅓ per cent. on the ordinary shares, payable in cash or in £1 ordinary shares at par.

South London Electric Supply Corporation.—The company announces that the sales of current for the quarter ended Michaelmas last amounted to £17,577 against £16,755 for the corresponding quarter of last year.

Edison & Swan United Electric Light Co.—The dividend warrants in respect of the dividend declared at the meeting on October 12th last, will be paid on Thursday, December 1st.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

County of Durham Electrical Power Distribution Co., Ltd.—20,000 5 per cent. preference shares of £5 each fully paid, Nos. 1 to 20,000.

Lisbon Electric Tramways, Ltd.—500,000 ordinary shares of £1 each fully paid, Nos. 1 to 500,000; 425,553 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 425,553; and £500,000 5 per cent. mortgage debentures of £100 each, Nos. 1 to 5,000 (registered).

Montreal Light, Heat and Power Co.—170,000 shares of $100 each fully paid of the capital stock (Montreal certificates).

Metallic Seamless Tube Co.—The annual meeting was held at Birmingham on 20th inst. Mr. W. Neale, the chairman, contrasted the present position of the company with the situation some time ago, and congratulated the shareholders on the improvement and the satisfactory prospects. For once he had to offer no apology for the absence of a dividend. The business was increasing largely and they had had to introduce fresh capital. The seconder of the resolution (Mr. G. Yorke Iliffe) said that the company was one of the very few tube-making companies which were working at a profit.

Cape Electric Tramways, Ltd.—A meeting of this company was held on Wednesday to consider a resolution authorising the directors to raise a sum not exceeding £200,000 by debentures, as already mentioned in our columns. Sir Charles Euan Smith, who presided, explained that the money was needed for relaying the line, and also for extensions to Builengraph. Mr. Rommell, the manager, said that the lines wore out quickly in consequence of the streets being washed with salt water, and owing to the dust storms. The resolution was carried after some opposition.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. *
Aberdeen	Oct. 21	2,489	— 95	21	31,705	— 1,646	..	..
Ayr	,, 21	413	..	23	8,925	— 117	8	..
Bath	,, 18	1,396	+ 110	42	29,080	+ 1,762	13	..
Birkenhead	,, 22	1,928	— 89	29	31,122	— 619	13·5	..
Blackburn	,, 18	1,818	— 89	29½	29,918	+ 966	14·25	..
Blackpool Corp.	,, 19	1,125	— 125	29	42,215	+ 1,934	11·87	..
,, —Fleetw'd	,, 21	592	— 26	16	18,371	— 880	..	..
,, —Lytham	June 22	1,602	+ 753	34	7,608	..	7½	..
Bolton	Oct. 22	3,680	+ 160	30	58,602	+ 2,035	26	+ 1
Bournemouth	,, 18	2,586	+ 275	28½	42,443	+ 6,959	17·4	+ 7½
Bradford	,, 21	8,329	— 521	29	131,740	— 7,006	53	..
Brighton	,, 22	1,700	..	30	32,917	..	9·5	..
Bristol	,, 20	9,614	— 67	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	Oct. 13	436	+ 18	41	8,428	+ 133	8·5	..
Barnsley	,, 13	323	— 24	,,	6,644	— 295	3	..
Barrow	,, 13	467	+ 103	,,	10,117	+ 2,114	5·37	..
‡Birmingham (City)	,, 13	10,381	— 674	,,	221,824	+ 2,026	14·5	..
Birmingham (Mid.)	,, 13	2,821	— 321	,,	66,248	+ 749	12·25	..
Devonport	,, 13	931	— 123	,,	19,203	— 2,879	8·85	..
Dudley—Sto'rb'ge	,, 13	1,700	+ 31	,,	37,456	+ 1,382	21·25	..
Gateshead	,, 13	1,919	+ 72	,,	37,806	+ 699	11·25	..
Gravesend, N'fleet	,, 13	452	+ 3	,,	9,700	— 920	6·5	..
Gr'n'k, Pt. Glsgw	,, 13	1,279	+ 171	,,	26,758	+ 2,918	7·25	..
Hartlepool	,, 13	567	..	,,	11,111	— 1,151	6·72	..
Kidderminster	,, 13	215	— 10	,,	5,162	— 285	4·5	..
Leamington	,, 13	311	+ 85	13	2,822	+ 1,130	..	..
Merthyr	,, 13	387	— 21	41	7,857	— 432	2·9	..
‡Metropolitan	,, 13	5,653	+2,055	,,	110,195	+48,677	..	..
Middleton	,, 13	627	+ 32	,,	14,220	+ 611	8·5	..
Oldham — Ashton	,, 13	1,159	- 5	,,	22,983	+ 427	9·13	..
Peterborough	,, 13	282	— 59	,,	5,795	— 567	5·31	..
Potteries	,, 13	3,641	+ 139	,,	69,710	+ 489	29	..
Rothesay	,, 13	167	+ 49	,,	9,195	+ 2,632	2·75	..
Sheerness	,, 11	129	— 2	,,	2,983	+ 305	2·5	..
Southport	,, 13	573	— 17	,,	13,346	— 433	8·17	..
South Staffs.	,, 13	1,676	+ 179	,,	29,985	+ 816	13·87	..
Swansea	,, 13	1,603	+ 584	,,	29,533	+ 7,043	5·5	..
†Taunton	Sep. 8	57	— 3	36	1,851	— 191	1·5	..
Tynemouth	Oct. 13	426	— 43	41	11,159	— 1,526	3·75	..
Weston-s-Mare	,, 11	158	+ 2	,,	6,526	+ 629	3	..
Wolverhampton D.	,, 13	853	+ 46	,,	16,321	+ 153	14·75	..
‡Worcester	,, 13	582	— 32	,,	12,817	+ 569	5·75	..
Wrexham	,, 13	193	— 4	,,	4,213	— 374	4	..
Yorks. Wool. Dist.	,, 13	1,361	+ 290	,,	26,987	+ 2,628	17	..
Burnley	Oct. 21	2,118	+ 59	..	..	..	7·5	..
Burton-on-Trent	,, 22	556	— 102	29	9,578	— 1,233	8·5	..
Bury	,, 15	1,396	..	28	21,249	..	10·5	..
Cardiff	,, 14	3,933	+ 87	28	60,317	+ 320	15·8	..
Carlisle	,, 21	337	— 22	42	7,863	— 531	..	..
Chatham and Dist.	,, 19	1,209	+ 46	42	28,145	+ 3,037	9·3	+ ·8
Colchester	,, 18	331	..	12	2,739	..	7	..
Cork	,, 19	923	— 33	42	20,748	+ 765	9·9	..
Darlington	,, 21	387	+ 33	29	6,058	..	4·87	..
Darwen	,, 20	475	+ 32	29	7,214	+ 337	4·36	..
†Dover	Aug. 12	344	+ 27	32	6,651	— 268	3·5	..
Dublin	Oct. 20	9,360	— 307	..	85,152	— 846	48·5	+ 1·5
Dundee	,, 18	1,988	+ 247	22	20,509	+ 934	12·5	..
East Ham	,, 21	1,485	+ 187	29	24,936	+ 2,656	6·75	..
Glasgow	,, 21	30,862	+1,376	20	317,196	+15,799	76	+ 3·5
Gloucester	,, 18	507	— 43	29	9,287	..	9	..
†Halifax	,, 4	1,501	+ 101	27	45,102	+ 2,010	37	+ 4
Huddersfield	,, 21	2,643	+ 121	29	40,355	+ 1,119	28	..
Hull	,, 21	5,483	— 28	29	65,530	+ 574	13	..
Ilford	,, 21	810	+ 35	30	14,689	+ 222	..	..
Ilkeston	,, 18	217	— 37	29	3,566	— 761	3·5	..
Ipswich	,, 21	704	— 128	29	13,809	— 1,696	10·5	..
Isle of Thanet	,, 21	659	— 153	42	29,074	— 3,095	..	..
Kirkcaldy	,, 18	386	— 37	..	..	..	7·5	..
Lan'kshire Trm. Co.	,, 19	1,632	+ 285	42	31,011	+ 3,681	12·5	+ 3·9
Leeds	,, 21	11,295	+ 202	29	180,764	+ 3,553	89·5	+ 8
Leicester	,, 21	4,272	+ 459	42	87,857	+28,034	..	..
Liverpool	,, 14	21,278	+ 21	41	435,579	+ 8,840	104	+ 1
L.C.C.	,, 7	29,182	+2,493	27	412,834	+62,232	51½	+ 4⅝
Lowestoft	,, 21	335	— 6	3	515	— 38	3·5	..
Manchester	,, 21	24,673	+ 283	29	381,159	+15,422	..	..
Newcastle	,, 21	7,364	— 145	29	112,242	+ 2,984	..	..
Newport	,, 21	1,062	+ 74	3	1,623	+ 136	14·5	+ 1·5
Oldham	,, 22	3,292	+ 851	30	49,900	+13,448	23·75	+ 5⅞
Plymouth	.. ..	..	..	..	..	..	..	..
Pontypridd	,, 21	287	..	29	4,916	..	3·5	..
Portsmouth	,, 21	3,134	— 275	29	64,300	+ 1,222	14·5	..
†Reading	,, 19	549	— 60	29	19,143	— 831	..	..
Rochdale	,, 21	1,592	+ 837	29	22,875	+17,123	21·3	+ 8
Salford	,, 17	8,130	+ 62	29	125,775	+ 6,684	..	..
Scarborough	,, 21	129	..	42	7,474	..	4·5	..
Sheffield	,, 22	9,476	+ 216	30	149,205	+ 6,677	35·75	-1·5
†Southampton	,, 18	1,784	— 76	2½	2,286	— 393	..	..
Southend-on-Sea	July 26	1,089	+ 67	17	6,596	+ 468	6·25	..
Stalyb'dge,Hyde,&c.	Oct. 14	1,248	+ 374	28	18,718	..	21	..
†Stockport	,, 13	780	+ 291	28	21,704	+ 4,494	15·5	+ 4
†Sunderland	,, 22	1,198	— 40	29	40,003	+ 980	..	..
Swindon	,, 18	361	..	29	5,939	..	4·4	..
Tyneside	,, 18	731	— 113	42	17,567	+ 883	8·87	..
Warrington	,, 19	673	+ 29	29	9,988	+ 490	6·37	+ ·25
West Ham	,, 19	3,919	+1,776	29	52,192	+21,816	13·25	+3·4
Wolverhampton	,, 18	1,499	..	..	..	..	10	..
Cen. London Rly.	Oct. 21	13,837	— 357	16	95,748	— 1,502	6	..
City & S. Lon. Rly.	,, 22	5,487	+ 145	16	38,613	— 428	6·25	..
Dublin-Lucan Rly.	,, 20	216	— 25	16	2,260	+ 6	7	..
G. N. and City Rly.	,, 21	3,265	+ 627	16	23,678	+ 5,945	3·5	..
L'pool Overh'd Rly.	,, 22	2,880	— 118	12	26,592	— 972	6·57	..
Mersey Railway	,, 21	3,181	+ 203	16	24,931	+ 1,570	4·5	..

* Compared with the corresponding period of 1904. † One week only.
‡ Includes horse and other receipts.

STOCKS AND SHARES.

Wednesday evening.

Markets remain in a slightly nervous condition, sensitive to every variation in Lombard Street and apprehensive of unknown troubles. Investors show a disposition to wait upon the trend of events, but they are making their presence noticed in the Home Railway department, one of the few markets displaying anything like strength this week. Electric Supply issues have fallen back to some extent, after their recent little spurt, but the Telegraph section is firm, and a few rises in Traction descriptions may be ascribed to the better tone of Home Railway stocks.

With regard to the latter, a rise of 2 in City and South London Ordinary will be doubly welcome to the holders of the stock, because of the long interval since the price last gave any signs of animation. Central Londons have so far failed to participate any further in the general strength, but they have, of course, been put up several points during the past few weeks. Districts have risen 3⅜, to 38½, upon the improvement of the traffics, to which attention was directed in our last Notes. The increases amount to little enough, but are taken by some people as a good omen for the future, now that the electrification of the line is so nearly completed. In the firmness of the market, as a whole, Districts may be put higher, but the stock is not worth the present price upon merits, however much ingenuity its special pleaders exercise upon the figures, present and future. Metropolitan Consolidated put on 2½, to 91½, and East London stays about 5½.

Strong buying of London Motor Omnibus shares has raised the price to 2¼, an advance of $\frac{5}{16}$, and a maiden dividend at the rate of 5 per cent. is prophesied, so there is quite likely to be profit-taking before long. British Electric Traction Ordinary are ⅛ better at 9⅞, and the revival of trade round the country should prove beneficial to the concern. London United Tramways Preference shares are 10. The Argentine group stiffened, under the leadership of Anglo-Argentine Ordinary, ⅜ up at 8$\frac{13}{16}$, the Preference being 6. Accounts from Buenos Ayres point to the railway strike being all but over. Belgranos are 3$\frac{13}{16}$, and the "A" Preference a couple of pounds more. Auckland Tramway 5 per cent. Debenture has been done at 105, and Potteries 4½ per cent. Debenture at 103½. In advancing to 9¼, Calcutta Trams put on $\frac{11}{16}$, the new shares also being a good market at 8¾.

For some reason difficult of understanding, the whole Electric Lighting list weakened upon the new proposals of the Westminster Co. This undertaking issued notices calling its proprietors together next Tuesday to consider suggestions for increasing the share capital to £2,000,000, and both Ordinary and Preference fell sharply, the former as much as 22s. 6d., to 12. Apparently a section of the proprietors took alarm at what they seemed to regard as a possible swamping of the market with new shares, a course not in the least likely to be pursued. Colour may be lent to this theory by the directors' intention to issue £250,000 in new Preference shares if the scheme is carried, but the announcement gives no hint of any determination to appeal for more money than this at present. Further proposals are submitted for the reduction of the Preference interest to 4½ per cent., a fall of ½ per cent., present holders to be compensated by the issue to them of one new Preference share free of charge. Shrewd investors will see an excellent opportunity in this slump to acquire cheap stock.

Sympathising with the decline in Westminsters, the market altogether is weak, and several falls are to be noted. Brompton 7 per cent. Preference fell ¼, and so did City of London and Edmundson's 6 per cent. Preference, the inference being that the interest upon all of these may be lowered if the Westminster's suggestions are carried. Charing Cross Ordinary lost ⅜ of their last week's improvement, while County of London's rapid rise tempted realisations, with the result that the price fell ¼ to 10 middle. St. James's Ordinary are the same fraction easier at 14½, although the 7 per cent. Preference, paradoxically enough, added ½ to 9. This is the solitary improvement in the list, except for a hardening of a couple of Debenture stocks.

Interesting particulars for London travellers are contained in the third annual report of the Underground Electric Railways Co., although essential details with regard to finance are extremely meagre. The Baker Street and Waterloo line should be open six months hence; the 4 per cent. Debenture stock, we may add, is quoted par to 102. The Great Northern, Piccadilly and Brompton line will, it is expected, be open at the end of 1906, and the Charing Cross, Euston and Hampstead a few months later. Quotations for the 4 per cent. script of each, with £75 paid, are 75½ and 75 respectively. The Underground Electric Railways Co. has an authorised amount of 7 millions sterling in profit-sharing notes, of which £3,599,200 are issued, and not the whole amount, as some financial critics appear to imagine. The price is about par.

Manufacturing shares are rather better on the whole. British Insulated rose to 7, and Callender's to 11½. Belliss & Morcom have not changed, despite the lamented death of Mr. Belliss. The works at Edgbaston were closed last Saturday, upon the occasion of the funeral.

Eastern varieties went better, in the Telegraph market, "China" shares adding 10s. to their price upon the issue of a very satisfactory report. Eastern Telegraph stock rose a point, and Direct United States Cable shares are 10s. harder. The Anglo-American Telegraph stock¼ are virtually unaltered, but Western Telegraphs rose 10s. also by reason of the issue of a report speaking of substantial progress. In the Telephone section, Monte Video Ordinary shares are the only ones calling for attention, with their advance of ⅛, to ⅛. The Preference stand at the same price.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905. §	Closing Quotations Oct. 18th.	Closing Quotations Oct. 25th.	Business done week ended Oct. 25th, 1905. Highest	Lowest.	Rise + or Fall —
34,800	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	..	99—102	99 —102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 - 3⅛	3 — 3⅛	3 1/16	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	82 — 87	82 — 87	..	..	..
763,580	Anglo-American Telegraph	Stock	60/6	61s.	2⅜%	29s. §	60 — 62 xd	60 — 62	..	..	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5⅛%	58s. §	108½—109½xd	108 —109	108⅜	107½	— ½
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	16¼— 16⅝	16¼— 16⅝	16 3/16	16 1/16	— ⅛
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..
1,932,856£	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	97 — 99	97 — 99	98	97⅞	..
16,090	Cuba Telegraph	10	6¾%	10 %	5 %	5 %§	9 — 9½	9 — 9¼	..	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %§	17½— 18½	17½— 18½	17½	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %§	3⅝— 3⅞	3⅝— 3⅞	..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %§	9¼— 9⅝	9¼— 9⅝	..	..	..
30,000	Do. do. 4½ % Debs.	50	4¼%	4¼%	4¼%	4¼%§	100 —103	100 —103 %	..	..	..
60,710£	Direct United States Cable	20	3½%	3 %	3½%	3 %§	12¼— 12⅝xd	12⅝— 13⅛	13¼	12⅝	+ ⅛
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	100 —102	100 —102	100⅝	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 %§	142 —145 xd	143 —146	144½	143½	+1
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%§	89 — 91 xd	89 — 91	90⅝	89½	..
1,836,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	4 %§	108 —110	108 —110	109¼	..	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	6 %§	13⅞— 14⅛xd	14⅛— 14⅜	14⅜	14 1/16	+ ⅛
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %§	106 —108	106 —108	..	..	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	..	99¾—101½	99¾—101½	100⅝	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	101½—103½	101½—103½%	101½	..	..
180,887	Globe Telegraph and Trust	10	£3	5⅜%	5⅜%	..	10⅝— 11	10⅝— 11	10 7/16	10⅜	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14⅜— 14⅝	14⅜— 14⅝	14 1/16	..	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	35½— 36½	35½— 36½	36 1/16	..	..
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	54½— 56½	55 — 57	56¼	..	+ ½
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	4 %	..	½— ⅝	½— 1	1	⅝	+ ⅛
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %§	112 —113	112 —113	112⅝	112	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %§	107 —108	107 —108	108	107	..
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %§	13 — 15	13 — 15	14¼	14	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %§	12 — 13	12 — 13	..	..	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %§	5⅝— 5⅞	5⅝— 5⅞	5 13/16	5⅝	..
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	98 —100	98 —100	98¼	..	..
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	104 —106	104 —106	..	..	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6¾%	6¾%	6 %	1½— 1⅝	1½— 1⅝	..	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1⅛— 1⅛	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	100 —103	100 —103	..	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	5 %§	7¾— 8¼xd	7¾— 8¼	..	..	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	125—128 xd	125 —128	125½	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7½	7 — 7½	7½	7⅜	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5¼— 5⅜	5¼— 5⅜	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	110 —112	110 —112	112	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	10 — 10¼	10 — 10⅜	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅜— ½	1/16— 1/8	..	..	— 1/16
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	14 — 14½	14⅛— 14⅜	14⅜	14⅛	+ ⅛
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	101 —103	101 —103	..	..	..
563,380	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	102½—104½	102½—104½	..	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1/16— ⅛	1/16— ⅛	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8⅛— 9	8⅛— 9	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7⅞— 8¼	7⅞— 8	7⅞	..	— ¼
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	101 —104	101 —104	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

850,000	Anglo-Argentine Trams, 260,008 to 430,007	5	..	..	8 %	6 %§	8 5/16— 8 7/16	8 11/16— 8 15/16	..	..	+ 3/16
1,300,035	Do. 5½ % Cum. Prefs., 1 to 260,007	5	..	5 %	5 %	5½%	5⅞— 6⅛	5⅞— 6⅛	..	..	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	141 —144	141 —144	..	..	..
200,000	Auckland E. Trams., 5 % 1st Mort. Deb. Stock	100	..	5 %	5 %	5 %	104 —106	104 —106	..	..	..
530,000	Babcock & Wilcox, 1 to 530,000	1	..	17 %	20 %	16 %‖	3⅞— 4 xd	3⅞— 4	..	..	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	..	6 %	6 %	6 %	1 7/16— 1 9/16xd	1 7/16— 1 9/16	..	..	..
40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	5 — 5⅛	5 — 5⅛	5⅛	5 3/16	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅞— 5⅛	4⅞— 5⅛	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2¾— 3¼	2¾— 3¼	2 13/16	..	..
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	100—104	100 —104	..	..	..
300,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	..	126 —129	126 —129	..	..	..
300,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	..	109 —112	109 —112	..	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	105 —108	105 —108	..	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	101 —103% xd	103 —105%	..	..	+2
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	100 —103	100 —103	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	9¼— 10	9⅝— 10⅜	9 15/16	9½	+ ⅛
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	11— 11⅛	11 — 11⅛	11 1/16	11	..
1,000,000£	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	121 —123	121 —123	122⅛	121⅛	..
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	99 —101	99 —101	100⅜	..	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %§	6¾— 7	6⅞— 7⅛	..	..	+ ⅛
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %§	5⅞— 6⅛	5⅞— 6⅛	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%§	103 —106	103 —106	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	..	4½%	4½%	4½%	98 —100	98 —100	..	..	..
2,000,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	2⅜— 2⅝	2⅜— 2⅝	..	..	..
1,016,353	Do. do. 4 % Mort. Deb. Stock	100	..	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅝— 1⅛	⅝— 1⅛	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	½— ¾	½— ¾	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1¼— 1⅜	1¼— 1⅜	1 3/16	..	..
125,000£	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	93 — 97	93 — 97	95	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	78 — 81	78 — 81	79¼	..	..
500,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	..	3 11/16— 3 15/16	3 11/16— 3 15/16	..	..	..
200,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	..	5⅜— 5⅝	5 11/16— 5 15/16xd	..	..	+ 3/16
137,500	Do. "B" do. 1 to 27,500	5	..	6 %	6 %	..	5 — 5⅛	5 — 5⅛ xd	..	..	..
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	106 —108	106 —108	..	..	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	102 —105	102 —105	..	..	..
525,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	7 %§	9¼— 9⅝	9 — 9⅜	..	..	— ⅛
163,050	Do. 105,001to 137,610	5	..	..	..	3d.	8⅝— 9⅛	8½— 9	..	..	— ⅛
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4 %	4½%	107 — 109	107 —109	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	10%	10¾— 11¼	11 — 12	11½	11 3/16	+ ⅛
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5⅞	..	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	109 —111	109 —111	110½	110	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %§	1⅛— 1⅜	1 — 1⅛	1 1/16	..	— ⅛
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	..	¾— 1	¾— 1	..	..	..
230,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	97 —102	97 —102	..	..	..
1,963,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %§	91 — 93	91 — 93	91	..	..
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %§	101 —103	101 —103	..	..	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	83 — 86	83 — 86	85½	84	..
1,380,000	City and South London Railway	Stock	3½%	2⅞%	2½%	2 %§	40 — 42	42 — 44	43½	42⅜	+2
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	..	1⅜— 1⅞	1⅜— 1⅞	1 15/16	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	95 —100 %	94 — 99	97	..	—1

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends
‖ And bonus of 10s. ¶ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	§1905.	Closing Quotations Oct. 18th.	Closing Quotations Oct. 25th.	Business done week ended Oct. 25th, 1905. Highest	Lowest.	Rise + or Fall −
260,000	Dick, Kerr & Co., 1 to 52,000	† £5	..	..	10 %	..	8¾ — 9 xd	8⅝ — 9	..	..	..
305,000	Do. do. 6 % Cum. Pref., 1 to 61,000	£5	..	6 %	6 %	6 %	6 — 6¼ xd	6 — 6¼	..	..	..
294,150	Do. do. 4½ % Deb. Stock	£100	..	4½%	4½%	4½%	106 —108	106 —108	..	..	..
600,000	Dublin United Trams. (1896), 1 to 60,000	£10	..	5⅝%	6 %	3 %	13¼ — 14½	13¼ — 14½	..	..	..
599,700	Do. 6 % Pref. between 1 and 60,000	£10	..	6 %	6 %	6 %	15 — 16	15 — 16	..	..	..
63,400	Do. 4 % Debs.	£100	..	4 %	4 %	..	99 —101	99 —101	..	..	..
300,000	Do. 3½ % "A" Debs.	£100	..	3½%	3½%	..	98¾ xd	97 — 99	..	..	— ½
300,000	Do. 3½ % "B" Deb. Stock	£100	..	3½%	3½%	..	97½	97 — 99	..	..	+ ½
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	£5	Nil	Nil	2½%§	..	1⅝ — 1⅞ xd	1⅝ — 1⅞	..	..	..
17,139	Do. "A" shares, 01—017,139 ..	£5	Nil	Nil	2½%§	..	2 — 2¼ xd	2 — 2¼	..	..	..
344,023£	Do. 4 % Deb. Stock Red.	£100	4 %	4 %	4 %	..	85 — 90	85 — 90	86½	..	..
100,000£	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	£100	5 %	5 %	5 %	..	92 — 97	92 — 97	..	..	..
112,100	Electric Construction 1 to 112,100	£2	6 %	4 %	Nil	..	⅞ — ⅞	⅞ — ⅞	⅞	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	£2	7 %	7 %	7 %	..	1¼ — 2⅛	1⅛ — 2⅛	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	..	92 — 95	92 — 95	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	£10	5 %	5 %	5 %	..	9¼ — 10	9¼ — 10	..	..	..
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	..	96 —100	96 —100	..	..	..
780,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	£10	..	3 %	4 %	4 %§	5 — 5½	5 — 5½	..	..	..
96,000	Greenwood & Batley 7 % Cum. Pref.	£10	..	7 %	7 %	7 %	10⅜ — 11	10⅜ — 11	..	..	..
80,000	Do. do. 5 % Mort. Debs.	£100	..	5 %	5 %	5 %	.. ..	.. ..	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	£5	20 %	15 %	15 %	10%§	12 — 13	12 — 13	12 3/16	..	..
200,000	Do. do. 4½ % Pref.	£5	4½%	4½%	4½%	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..
45,900	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	£10	10 %	10 %	5 %	2½%§	15⅛ — 16⅛	15⅛ — 16⅛	..	..	..
300,000£	Do. do. 4% 1st Mort. Deb. ..	£100	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	£10	1⅜%	1⅜%	1½%	..	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..
10,000	† Do. do. Pref. £10 paid ..	£10	5 %	5 %	5 %	5 %	9 — 9½	9 — 9½	..	..	..
600,070	London United Trams (1901), 1 to 50,007 ..	£10	..	8 %	6 %	4 %§	10 — 11	10 — 11	..	..	..
399,930	Do. do. 60,008 to 100,000 (£4 paid) ..	£10	..	8 %	6 %	4 %§	4 — 5	4 — 5	..	..	..
1,125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	£10	..	5 %	5 %	5 %	9⅞ — 10½	9⅞ — 10½	..	..	..
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	£100	..	4 %	4 %	4 %	100 —103	100 —103	..	..	..
160,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	£5	..	..	6 %	6 %	4⅞ — 5⅛ xd	4⅞ — 5⅛	..	..	..
240,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	£10	..	5 %	5 %	..	8⅞ — 9⅛	8⅞ — 9⅛	..	..	..
240,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	£10	..	5 %	5 %	5 %	9 — 9½	9 — 9½	..	..	+ ⅛
245,000	Do. 4½ % Deb. Stock	£100	..	4½%	4½%	..	101 —104	102 —105	..	..	+1
37,350	Telegraph Construction and Maintenance ..	£12	20 %	20 %	15 %	..	33½ — 35½	33½ — 35½	34½	..	..
150,000£	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	£100	4 %	4 %	4 %	..	102 —104	102 —104	..	..	..
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	..	5 %	5 %	99½—100½	99½—100½	..	..	..
540,000	Waterloo & City Railway, Ord. Stock	£100	3⅛%	3⅛%	3⅛%	3 %§	88 — 90	90 — 92	..	..	+2
333,330	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	£5	..	6 %§	..	..	1⅛ — 2	1⅛ — 2	..	..	..
333,330	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	£5	..	3 %	..	..	2⅛ — 3⅛	2⅛ — 3⅛	..	..	..
246,806	Do. 4 % 1st Mort. Deb. Stock	£100	..	4 %	4 %	..	74 — 79	74 — 79	..	..	..

ELECTRICITY SUPPLY COMPANIES.

70,000	Bromley (Kent) E.L. & P., 1 to 14,000	£5	..	5 %	5⅛%	4 %§	5⅛ — 5⅜ xd	5⅛ — 5⅜	..	..	..
50,000	Do. do. 4½ % 1st. deb. stock ..	£100	..	4½%	4½%	4½%	104 —107	104 —107	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	£5	8 %	10 %	10 %	..	9⅜ — 10⅛	9⅜ — 10⅛	9⅝	..	..
29 623	Do. do. 7 % Cum. Pref.	£5	7 %	7 %	7 %	..	9¼ — 10	9¼ — 9⅝	9 5/16	9¼	— ⅛
10'782	Central Electric Supply 4 % Guar. Deb. Stock ..	£100	4 %	4 %	4 %	..	105 —108	105 —108	105⅝	..	..
80,000	Charing Cross and Strand Electricity Supply ..	£5	10 %	8 %	8 %	5 %§	7⅞ — 8⅛	7⅞ — 8	7 15/16	7⅞	— ⅛
80,000	Do. do. do. 4½ % Cum. Pref.	£5	4½%	4½%	4½%	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5 7/16	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	£5	4½%	4½%	4½%	..	4⅞ — 5	4⅞ — 5	..	..	..
40,000	Do. do. 1903	£5	..	4½%	4½%	..	4⅝ — 5⅛	4⅝ — 5⅛	4 13/16	..	..
350,000	Do. do. 4 % Deb. Stock Red. ..	£100	4 %	4 %	4 %	..	103 —105	103 —105	104⅛	103½	..
44,436	Chelsea Electricity Supply, Ord.	£5	4½%	5½%	6 %	4½%§	5⅜ — 6¼	5⅜ — 6¼	6 7/16	..	..
150,000£	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%§	109 —111	110 —112	112	111⅝	+1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	£10	5 %	5 %	6 %	..	12¾ — 13¼	12⅞ — 13	12⅝	12⅜	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	£10	6 %	6 %	6 %	..	13⅜ — 14⅜	13¼ — 14¼	13 5/16	13⅜	— ⅛
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	124 —128	124 —128	..	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	£100	4½%	4½%	4½%	..	104 —106	104 —106	104⅛	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	£10	4 %	4 %	4½%	4 %§	10 — 10⅛	9⅞ —10⅛	10	..	— ⅛
30,000	Do. do. 6 % Pref., 40,001—60,000	£10	6 %	6 %	6 %	..	12⅜ — 12⅝	12⅜ — 12⅝	..	..	..
400,000£	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	..	111 —114	111 —114	114	..	..
250,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	104 —106	104 —106	..	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares ..	£5	7 %	7 %	7 %	..	5⅝ — 6¼	5⅛ — 6	5⅝	..	— ⅛
80,000	Do. do. 6 % Cum. Pref... ..	..	6 %	6 %	6 %	..	6⅜ — 6⅝	6⅜ — 6⅝	6 7/16	..	..
300,000£	Do. do. 4½ % 1st Mort Deb. Stk	£100	4½%	4½%	4½%	..	108 —110	109 —111	109½	..	+1
50,000	Folkestone, 1 to 10,000	£5	..	5⅛%	5⅛%	4 %§	5¼ — 5⅜ xd	5¼ — 5⅜	..	..	..
50,000	Do. 5 % Cum. Pref., 1 to 10,000	£5	..	..	..	5 %	5 — 5⅛ xd	5 — 5⅛	114	..	..
50,000	Do. 4½ % 1st. Deb. Stock	£100	..	4½%	4½%	4½%	99 —102	100 —103	..	..	+1
65,000	Hove, 1 to 13,000	£5	..	8½%	8½%	..	8 — 8¼ xd	8 — 8¼	..	..	..
10,000	Do. New (£5 10s. paid)	£3	..	8½%	8½%	..	5¼ — 6	5⅜ — 6¼	..	..	+ ⅛
37,300	Do. 4 % Deb. Stock	£100	..	4 %	4 %	4 %	94 — 97	95 — 98	..	..	+1
7,300	Do. 4½ % Deb. Stock	£100	..	4½%	4½%	4½%	96 — 99	95 — 98	..	..	—1
21,000	Kensington and Knightsbridge Electric Ord. ..	£5	10 %	12½	12 %	..	12 — 12⅝	12 — 12⅝	..	..	..
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	97 —100	98 —101	..	..	+1
111,000	London Electric Supply Corporation, Limited, Ord.	£3	Nil	Nil	3 %	..	2 — 2⅛	1⅞ — 2⅛	..	..	— ⅛
60,000	Do. do. do. 6 % Pref...	£5	6 %	6 %	6 %	..	5⅞ — 6⅛	5⅛ — 5⅝	..	..	..
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	£5	7½%	8½%	10 %	10%§	10 — 10⅛	10 — 10⅛	10⅛	10⅛	..
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	£5	4½%	4½%	4½%	..	5⅝ — 5⅞	5⅝ — 5⅞	..	..	..
220,000£	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	..	109 —113	109 —113	..	..	..
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	98 —100	98 —100	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	102 —104	102 —104	102	..	..
285,045	Newcastle-on-Tyne, 1 to 57,009	£5	..	8 %	8 %	2½%§	8 3/16	8 — 8¼	..	..	+ 1/16
89,955	Do. 57,010 to 75,000	£5	..	..	..	2/4½	7⅜ — 8⅛	8 — 8¼	..	..	+ ⅛
285,045	Do. 5 % Pref., 1 to 57,009	£5	..	5%	5	5 %	6¼ — 6⅜	6¼ — 6⅜	..	..	..
89,955	Do. 57,010 to 75,000	£5	..	..	..	2/4½	6¼ — 6⅜	6¼ — 6⅜	..	..	..
10,852	Notting Hill Electric Lighting	£10	6 %	6 %	7 %	..	14 — 15	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb... ..	£100	4 %	4 %	4 %	..	98 —100	98 —100	..	..	..
92,500	Oxford, 1 to 96 and 407 to 18,810	£5	..	6⅛%	7 %	5 %§	6⅜ — 6⅝	6⅜ — 6⅞	..	..	..
50,000	Do. 4 % Deb. Stock	£100	..	4 %	4 %	4 %	100 —102	100 —102	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord. ..	£5	14½%	14½%	14½%	10%§	14½ — 15½	14 — 15	14⅜	14⅛	— ⅛
20,000	Do. do. 7 % Pref. 20,081 to 40,080	£5	7 %	7 %	7 %	7 %§	8 — 9	8⅜ — 9⅛	..	..	+ ⅛
150,000£	Do. do. 3½ % Deb. Stock Red. ..	£100	3½%	3½%	3½%	..	99 —101	98 —100	99⅞	99½	..
12,000	Smithfield Markets Electric Supply, Ord.	£5	2½%	4 %	4 %	..	2 — 2⅛	2 — 2⅛	..	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	£5	1⅜%	3 %	4 %	..	3⅜ — 4⅛	3⅜ — 4	3 11/16	..	+ ⅛
100,000	South Met. Elec. Lt. & Power (Ord..	£1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..
50,000	*(Late Blackheath and Greenwich* (7 % Pref... ..	£1	Nil	7 %	7 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..
100,000	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	105 —108	105 —108	..	..	..
30,000	Urban Electric Supply, Ord.	£5	5 %	5 %	5 %	..	4⅝ — 4⅞	4⅝ — 4⅞	..	..	..
30,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	..	5 — 5½	5 — 5½	..	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	..	103 —105	103 —105	104½	..	..
110,000	Westminster Electric Supply, Ord.	£5	12 %	13½%	14 %	13%§	12⅝ — 13⅜	11⅝ — 12¼	13	12	—1⅛
28,151	Do. do. 5 % Cum. Pref. ..	£5	5 %	5 %	5 %	..	6⅜ — 6⅝	5⅝ — 6⅜	6	5⅝	— ¼

Shares not officially quoted :—Mackay Companies, ord., 47—48. Pref. 75½—76½.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 4 per cent. (September 28th, 1905).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1905.

Although not such as we could wish, the present returns show satisfactory features in comparison with those of the preceding month. Thus our exports of electrical wares have increased, amounting to £101,721, as compared with £98,362 in the month of August, while the imports of such materials have fallen from £115,949 to £103,471 for the same period. The re-exports totalled some £8,335, which contrasts with £6,148 in the month of August.

A glance at the table reveals the fact that a marked increase occurred in our cable exports, coupled with a drop in the corresponding imports; while telephone exports and imports are both diminished in comparison with the previous month.

No telegraph material, registered as such, is recorded in the table, and only a small export of tramway material.

So far as imports of electrical machinery are concerned, the total value for the first nine months of the current year shows a decrease of over £50,000 in comparison with the corresponding period of 1904, and a rather greater decrease as compared with the first nine months of 1903.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electric light and power cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telephone material and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Norway, Sweden and Denmark	651	138	87	48	...	447	290	...	282	...	...
Germany	94	...	9	6	217	375	...	...	41	...	...
Netherlands	13	194	574	37	...	302	400	4	11	...	...
Dutch Borneo and Indian Possessions	...	...	26	44	350	13	...	...	...	...	...
Belgium	255	560	...	24	...	69	16	...	630	...	...
France	383	25	71	...	20	423	193	...	...	...	...
French Indo-China	...	...	22	...	...	...	...	...	...	...	...
Portugal, Portuguese Africa and Indies	154	56	20	34	...	815	8	35	84	...	...
Spain and Canary Isles	102	182	253	59	...	2,789	...	...	27	...	...
Italy and Austria-Hungary	10	30	...	...	350	4	75	...	...	43	...
Greece and Bulgaria	...	...	23	...	...	12	...	...	...	...	...
Turkey and Persia	...	...	...	...	...	92	...	...	3	38	...
Egypt	94	56	80	50	38	40	36	...	56	80	...
China and Siam	36	95	739	...	12	327	9	...	...	...	...
Japan	135	1,367	...	...	245	220	...	9	...	...	...
U.S.A., Philippines and Cuba	113	...	57	187	40	2,521	19	...	...	94	...
Mexico Colombia and Uruguay	250	1,310	25	...	25	149	...	...	...	...	...
Chili	162	1,286	103	168	...	60	68	3	89	27	...
Brazil	243	81	42	106	5	2,722	...	...	...	355	...
Argentine	812	338	281	546	540	372	452	20	848	1,940	227
Channel Isles, Gibraltar and Malta	285	384	13	72	260	1,826	...	...	37	...	...
British West Africa	11	...	46	25	...	466	4	...	...	...	...
Cape of Good Hope	1,474	5,891	348	463	8	5,647	229	...	66	...	...
Natal	922	1,359	1,339	364	498	1,800	223	...	87	343	...
Zanzibar, Brit. East Africa, Mauritius and Aden	6	36	...	...	...	875	...	...	211	...	...
India	4,153	10,257	3,380	2,415	422	5,040	383	11	90	275	...
Burmah	...	102	212	2	...	3	19	...	23	...	...
Ceylon	...	...	102	...	37	28	14	...	30	...	...
Straits Settlements and Labuan	145	15	604	...	144	445	13	...	64	93	...
Hong Kong	60	2,275	475	...	75	13	...	...	3	116	...
West Australia	92	48	140	45	209	463	...	...	...	52	...
South Australia	144	417	52	6	9	155	34	...	...	...	...
Victoria	922	180	45	...	...	104	...	8	30	...	...
New South Wales	1,568	575	57	...	124	867	...	...	523	117	...
Queensland	...	17	7	...	9	45	...	...	...	...	...
Tasmania	...	197	...	...	555	41	...	...	...	...	...
New Zealand	139	213	542	115	185	1,319	108	...	415	...	...
Canada	...	...	17	33	...	148	130	...	3	...	...
British West Indies and British Guiana	230	...	56	...	...	...	1	...	...	2	...
Total, £	13,658	27,684	9,847	4,849	4,377	31,037	2,724	90	3,653	3,575	227

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	
Norway, Sweden and Denmark	38	...	...	122	...	2,303	53	..	6,498	...	...
Holland	9,472	319	1,591	74	...	639	...	2,878	656	...	...
Germany	6,214	1,015	619	865	...	9,793	846	281	1,643	...	...
Belgium	11,885	1,038	115	1,620	480	7,212	120	724	924	...	...
France	6,776	167	1,446	203	632	5,120	189	2,132	90	...	...
Italy	...	...	...	...	...	...	...	7	...	...	...
United States	4,300	223	263	315	88	11,177	97	63	27	119	...
Total, £	38,685	2,762	4,034	3,199	1,200	36,244	1,305	6,085	9,838	119	...

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	1,511	179	206	...	31	5,259	110	23	955	61	...

Total Exports: £103,471

Total Re-Exports: £8,335

Total Imports: £101,721

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

ELECTRIC SIGNALLING ON THE GREAT NORTHERN AND CITY RAILWAY.

Although the automatic operation of railway signals by electricity has not made much progress on British steam railways, owing to considerations which have often been discussed in our columns, this is by no means the case in connection with electric railways. Indeed, the adoption of automatic electrical signalling in this country may be said to date from the inauguration of the first overground electric railway, for it was on the Liverpool Overhead Electric Railway that such a system was first installed—more than 12 years ago.

The conditions of working on a self-contained electric railway, due to to the absence of junctions and to the simplicity and uniformity of the traffic, are peculiarly favourable to the use of automatic signalling, and hence it is, no doubt, that the latter has been adopted on the Great Northern and City Electric Railway. The work has been carried out entirely by Messrs. J. E. Spagnoletti and Co., of Goldhawk Works, a firm whose name is intimately bound up with railway signalling, and whose experience in the use of electric locking is unique. Messrs. Spagnoletti carried out the electric locking equipment of the City and South London, Central London and the Metropolitan Railway, under their own patents; on the Great Northern and City Railway, the work was done under the combined patents of Messrs. J. E. Spagnoletti, R. P. Brousson, and A. H. Binyon. The installation was carried out under the direction of the engineer and traffic manager, Mr. R. P. Brousson, whose experience on the Central London Railway enabled him to introduce valuable improvements, resulting in a marked decrease in the number of failures recorded, as compared with previously existing systems. We are informed that this successful collaboration has led to the formation of a company by Messrs. Spagnoletti & Co. and Messrs. Pearson & Sons (the contractors who built and equipped the railway) to exploit the system as now perfected. Messrs. Spagnoletti were represented on the work by Mr. A. H. Binyon, one of the co-patentees. The mechanical work in connection with the points and crossings was carried out by the Railway Signal Co., of Fazakerley, Liverpool.

The following is a brief description of the arrangement employed:—The system is operated by two independent methods of control, viz., the 100-volt control, which operates the signals themselves, and the 500-volt permissive control, which gives the signals permission to operate. The actual working of the signals is governed by a track circuit and by the position of the trains.

Signals at Automatic Stations for Through Traffic.—Simple direct working relays are placed across the track rails at one end of each section, and the current is fed in at the other end of each section at a pressure of about 3 or 4 volts. This current is supplied from a 100-volt generator at Highbury Station, and the pressure is reduced by lamp resistances between the 100-volt main and the track. The control solenoids worked off the 100-volt circuit are fixed in suitable cases in each cabin for each signal, and the position of these solenoids makes or unmakes certain contacts which govern the red and green positions of the tunnel signals. Each signal is interlocked with a signal in the rear, by arranging the bottom set of contacts in these cases in such a way that the signal behind the train must have dropped to red before the green signal can be given for the section which the train has just vacated. The armature of the release coil solenoid worked off the 500-volt circuit is placed immediately above the spindle of the 100-volt solenoid, in such a way that unless the armature is pulled sideways by the release coil current this spindle cannot rise.

The release coils are actuated by the 500-volt positive current fed from a brush fixed on the rear coach of the train, which makes contact with a treadle placed a certain distance in the section in advance of the section, the signal of which it controls.

Semi-Automatic Stations with Hand-worked Points and Crossings for Terminal Junction Working.—The control of the signals from the track is the same as for the simple automatic stations. The 100-volt solenoid coils governing the positions of the red and green signals are also similar in principle, but have in addition hand-worked plungers and the necessary interlocking between the mechanical portion of the signal work and the electrical, to ensure that the points and the signals agree.

The apparatus to obtain this locking consists of electrical contact-making devices on the point blades; electrical contact-making devices on the facing-point locks; electrical contact-making devices on the levers for points and facing-point locks in the signal cabins; plungers for clearing signals at junctions; and electric locks on levers for controlling signals.

In addition, block instruments worked off the 100-volt circuit are provided for controlling the platforms and portions of the line which are governed by two or more signals. These block instruments are provided with a permissive treadle control, worked from the 500-volt circuit on the trains, similar to that provided for the purely automatic stations.

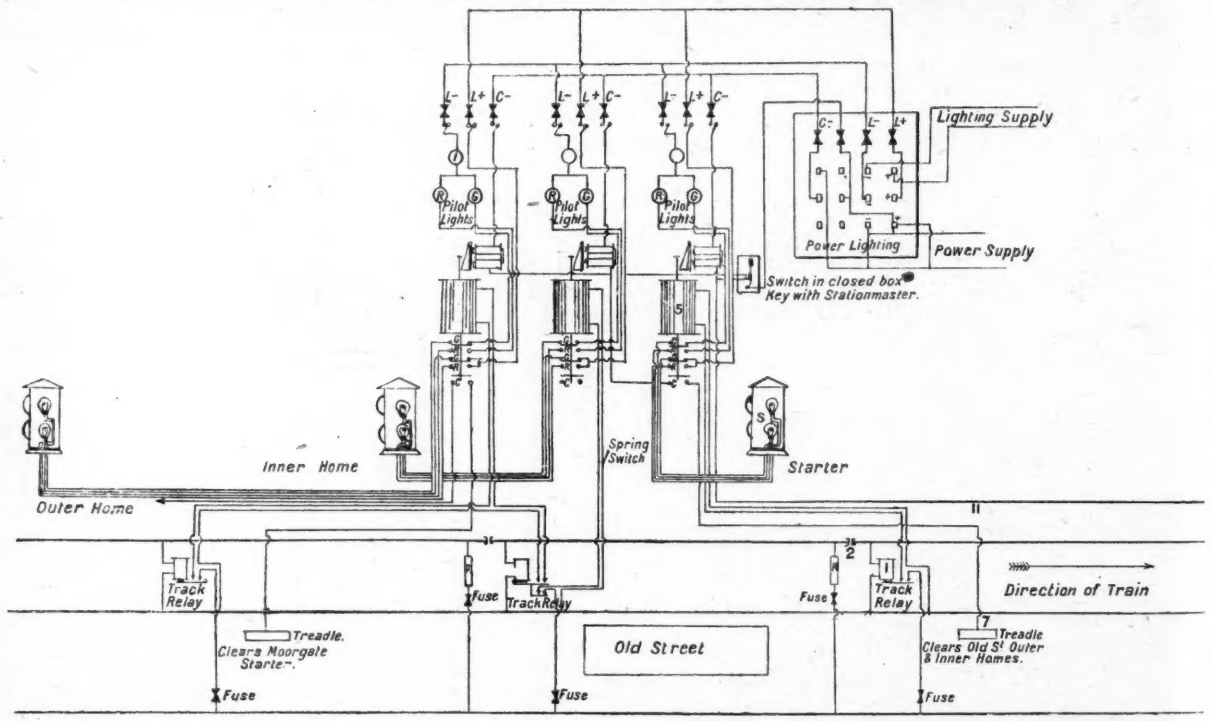


Diagram of Connections of Automatic Electric Signals.

General Arrangement of Track Circuits.—The track rails are cut up into different block sections by means of heavy oak fishplates and vulcanised fibre dividing pieces. This sectioning is only done on one rail; the other is made metallically continuous by means of bonds, from one end of the line to the other, on both up and down roads. The 100-volt main feeders, which are also run on both roads, are supplied from Highbury station, where there are installed two motor-generators, which transform the 500-volt into 100-volt current, which is fed into these tunnel feeders.

At the commencement of each track section in the direction in which the train is running is put a track relay, which is connected on one side to the section rail and on the other to the continuous rail. At the other end of the track section is put the track resistance, which feeds the insulated track from the 100-volt main. This resistance is constructed of incandescent lamps, wired in parallel, so as to get the required voltage on the track, viz., 3 volts to energise the relay at the other end.

The action of the track may be seen from the accompanying diagram. The train is approaching in the direction of the arrow, viz., from Old Street to Essex Road, and passes into the section made by the two fish-plates, 2 and 3; the wheels of the first car short-circuit the two rails and cut off the current from the relay 1, which demagnetises the coils of that relay, causing the armature to break the 100-volt current of the solenoid control instrument 5 in Old Street cabin.

This causes the solenoid spindle to fall, breaking the spring contacts G G, and thereby putting out the green light; closes the spring contacts R R C, putting on the red light; and also closes the treadle circuit 7 of the starting signal S. When this spindle falls, it is locked down by the armature 6 at the top of the solenoid coil 5. This operation locks the signal S at danger, so that there is

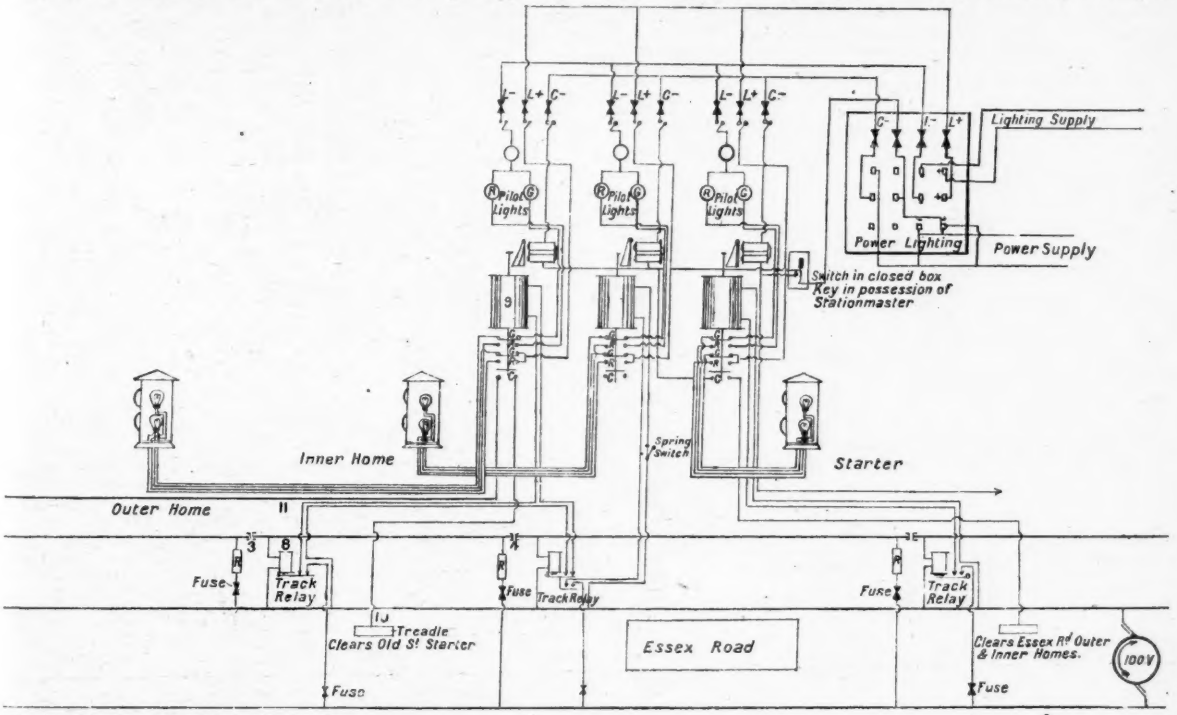
no possibility of the signal coming to green behind the train, even should there be sufficient rise in the track volts to energise the relay 1 again before the train is properly out of the section 2, 3, through leakage due to a short-circuit on the collector rail, or to the derailment of a train.

When the train is out of this section, the relay is once more energised, but the signal S does not come to green, because the spindle of the control instrument is locked down; this lock is taken off when the train has entered section 3, 4, and de-energised relay 8, which cuts off the 100-volt current from the outer home solenoid 9 of Essex Road, and closes the R R C contact and breaks the G G contacts. As the last coach passes the treadle 10, which is put some distance ahead of the section 2, 3, contact is made by a brush which is fed from the train, and the current flows from the positive on the train through the contacts C, along the wire 11 and round the release coils of the starter solenoid 5, at Old Street, pulling over the armature, and allowing the solenoid spindle to rise, thus breaking the R R C contacts, and making the G G contacts, which put the green light in the starting signals.

All the signals drop to danger in the event of failure of the 100-volt circuit. As regards the 500-volt circuit, if this fails—that is to say, if the current for operating the train fails—then the passing of the train over a treadle will not energise the treadle, and consequently, although the signal drops to red behind the train as it should, the signal controlling the section in the rear also remains at red. As on electrical lines the failure of the operating current generally means something wrong with the line, this is a considerable safeguard, as a failure of this current means that every train will have two or three signals behind it at danger, instead of one or two as under normal conditions.

The signalling at Essex Road and Old Street, and the up line signals at Drayton Park, are on this principle. At terminal stations the signals are controlled by the signalmen using plungers, and are pulled off if the road is properly set mechanically. Should the road not be properly set, the signals cannot, by any means, be got to green. The signals at Moorgate Street, Finsbury Park, and the Yard Junction at Drayton Park are controlled in this way.

The running of the Great Northern and City Electric Railway, from the first day, has been so free from interruption as to constitute what is probably a record, and there can be no doubt that the successful working of the signalling system has contributed very largely to this happy result.



Great Northern and City Railway.

ZÉNOBE GRAMME, 1826—1901.

Amongst the names of illustrious inventors and engineers, that of Zénobe Gramme will for ever take a distinguished place. Born in 1826 at Jehay-Bodegnée, he lived successively with his parents at Verlaine, Hannut, and Huy, and during the years 1849 to 1855, he settled in Liége. Eventually in 1856 he proceeded to Paris, where he lived until his death in 1902. In Liége he was merely a simple working carpenter, who found time, however, to attend for some years evening courses of instruction at the Ecole Industrielle. There he obtained that knowledge of physics, and of the application of mathematics to machine design, &c., which was shortly to cause such tremendous developments in the electrical engineering industry.

In considering the work of Gramme, one must take into account the extraordinary difficulties under which an electrical engineer in those days had to labour. There were no ammeters, no voltmeters, no standards of resistance, and no Hopkinson law of magnetic circuits.

We read in the interesting account of his methods of design referred to by M. E. Javaux, director of the Société Gramme, at the inauguration of a monument to his memory at Liége on the 7th inst. (*vide l'Electricien*, October 21st, 1905), that the E.M.F. of the machines he designed was compared with so many Daniell cells, and the strength of current with so many Bunsen cells, and resistances were compared by means of a differential galvanometer, with that of a kilometre of galvanised iron wire, 4 mm. in diameter. Again, in designing the magnetic circuit, he endeavoured to keep down the volume of copper for magnetisation; he used the term "Bunsen metres" instead of "ampere-turns." He noticed also that iron tended to a saturation limit for lines of induction, and took this into consideration.

By sheer experimental acumen he arrived at methods of design, which in their essentials differ but slightly from those in use at the present time.

When we consider that prior to the day of Gramme, people had to use voltaic batteries of the Bunsen, or Grove, type whenever they required a continuous current of any magnitude, we realise that his invention of the smooth-cored ring armature and commutator, enabling a practically constant current to be obtained, was an epoch-making discovery. His machines were immediately in request for the deposition of metals, electro-plating, &c.

Upon the invention of the Jablochkoff candle, Gramme invented his alternator for arc lighting purposes. Here we have what is practically a polyphase machine, only in those days the separate "phases" were not combined as we use them now. However, his machine was again remarkable, since he used a rotating magnet-wheel, the windings of the "stator" being of the Gramme type, and arranged in a frame surrounding the magnet-wheel as in present day alternators.

In the earlier part of his life, Gramme did not show any signs of great genius, although his sisters were extremely clever. He was inclined to use his hands rather than his head, and so he was apprenticed to a carpenter. Eventually, after attending the course of study at the Ecole Industrielle, Liége, he took great delight in designing and attacked the problem of dynamo designing, at first from the mechanical side.

Like many other pioneers, he knew what poverty was, but he was gifted with a sunny disposition, and never quailed before difficulties. Although he left Liége early for Paris, he never forgot his old companions, and remained a Liégeois at heart.

His life is a most encouraging example of the use which can sometimes be made by a student, of instruction received in the evening classes, and Liége is justly famous for her great electro-technical teaching institutions to-day.

Liége is right to honour her sometime citizen, or rather in the words of one of the speakers at the ceremony, to honour: "The workman, the thinker, the inventor." The monument was carved by the Belgian sculptor, Thomas Vinçotte. The widow of Zénobe Gramme occupied the place of honour, with other members of the family around her, and the Minister of Industry and Labour, M. G. Francotte, presided.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

(*Continued from page* 650.)

Chloride Battery Improvements.

The Chloride Electrical Storage Co., Ltd., have recently introduced several important improvements in detail in the various sizes of their well-known "R" type cell, the title of which in its modified design has been changed to "S" type. The plates are now hung from the sides of the glass boxes, and in place of the glass rod separators formerly used, a new type of wood separator is exclusively employed. This forms a continuous diaphragm between plates of opposite polarity, and among other advantages possesses the peculiar property of tending to maintain the capacity of a cell in a manner which cannot be effected by the older methods of separation. We show an illustration of a new line of cells which has been standardised to meet the demand for capacities between and below those of the "S" type, which is not now supplied for smaller outputs than 180 ampere-hours. The Exide negative is used with all sizes of plate, from the P.G., measuring about 4 in. × 3 in., to the "D" type, measuring 35 in. × 15 in. We learn that the Exide accumulator is giving excellent results in electrical vehicle work, the board separators enabling it to maintain its capacity to the full value it possesses when new, during the whole of its life, so that the mileage obtainable from a vehicle after a full charge is not a variable quantity.

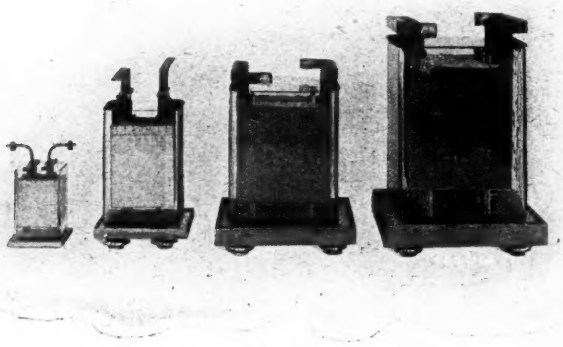


Fig. 85.—Chloride Co.'s New Line of Cells.

Motor-Car Batteries and Lamps.

In fig. 86 we illustrate an ignition accumulator for which a considerable demand has lately been experienced by the makers, Messrs. C. A. Vandervell & Co., Chapter Works, Chapter Road, Willesden, N.W. It is known as the C.A.V., and is supplied in celluloid case for motor bicycle and motor-car use. In the firm's illustrated list there is also shown an accumulator in ebonite, sealed into a strong teak box for motor boats and other service. Another speciality is the electric lamp (fig. 87) for motor cycle and car use; it has a special plug switch, a half turn switching on or off. This plug can be unscrewed and completely removed. This lamp is said to be the only one that gave no trouble in the London-Edinburgh run of the Motor Cycling Club last year. An 8-volt ½-ampere lamp is guaranteed to throw a powerful light 50 yards ahead. Electric head and tail lights, roof lamps for cars, and portable inspection lamps are further among the firm's supplies. It may also be added that Messrs. Vandervell are shortly putting on the market a complete electric lighting and ignition outfit for automobiles, which is designed to render a car absolutely "self-supporting" for lighting and for current for ignition. This consists of a patent dynamo intended to be driven from the engine, accumulator, electric side, rear, and headlights, and a patent coil for use with the distributors now in general use on multiple cylinder cars. This dynamo, we understand, is designed on a novel principle, and is being taken up by some of the principal motor manufacturers.

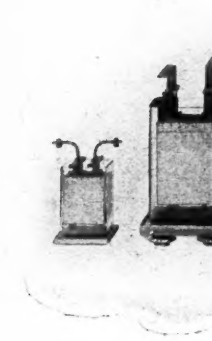


Fig. 86.

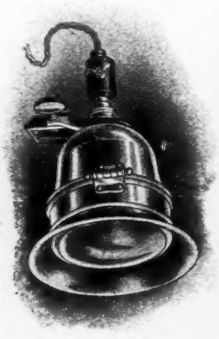


Fig. 87.

The "Atlas" Indicator.

The illustration (fig. 88) represents the "Atlas" secure-locking indicator, which Messrs. Falk, Stadelmann & Co., Ltd., are putting on the market. This indicator is constructionally quite different from the usual existing patterns. It is claimed to combine the advantages of mechanical indicators with those of the pendulum type. For use in ships, trains, and lifts, it is recommended because it is not affected by vibration or jars. The flags of movements cannot drop, except when electrically released, as they are securely locked on replacement by a catch, but not of the usual spring-locking type. Further, by reason of the compactness of the movements, the indicators occupy only small space. It is contended that for private house, office and hotel service, mechanical indicators would be preferred to those of the ordinary pendulum type on account of the permanent indication until the calls are attended to, were it not for the difficulty of replacing, and of the necessity of fixing them within reach at inconvenient heights. These objections the "Atlas" claims to overcome.

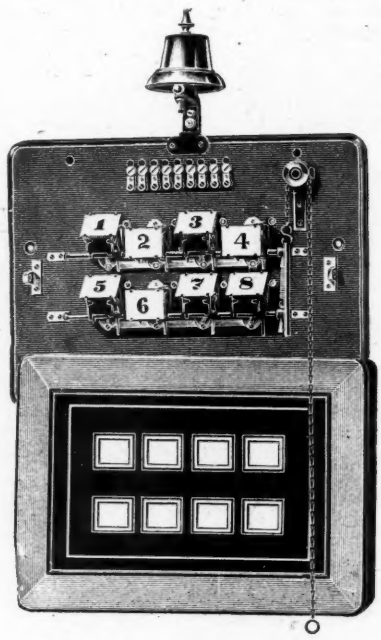


Fig. 88.—The "Atlas" Indicator.

Patent Bell Push.

It is impossible to set a limit to inventive ingenuity. One would have thought that the last word in bell-pushes had been said, but

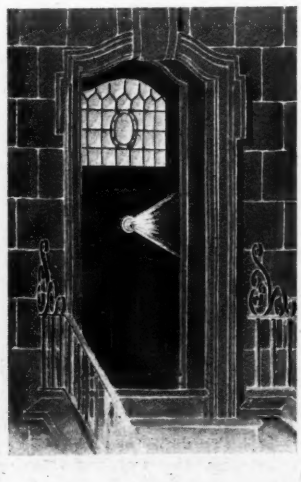


Fig. 89.

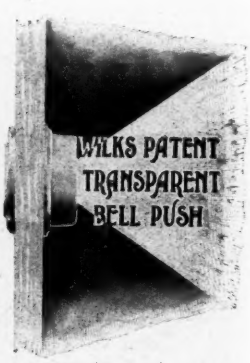


Fig. 90.

Messrs. Evered & Co., Ltd., have now come forward with the Wilks patent transparent bell-push, shown in figs. 89 and 90, through which

the hall-lamp's rays are free to pass, not only revealing the position of the push, but also throwing up in strong relief the laconic command "push!" There will now remain no excuse for paterfamilias. If he cannot find the keyhole, he cannot fail to see the bell-push, and when he tries to insert his latchkey into it, he will, of course, ring the bell!

Ediswan Fittings.

We illustrate herewith a couple of examples selected from the many designs in the Section VI. catalogue (artistic electric light fittings) recently received from the Edison & Swan United Electric Light Co., Ltd. This catalogue is a very complete one, and it comprises 130 pages of all sorts of designs. Numerous plain and fancy pendants, hall lanterns, dining,

Fig. 91. Fig. 92.

Ediswan New Fittings.

dressing and bed-room pendants, electroliers from the very plain to the beautifully ornamental and elaborate, plain and fancy standards, desk fittings, swinging and other brackets, candle brackets, some excellent specimens of bronzes, and many small accessorial parts, such as reflectors, chains, guards, switch covers and counterweights are all well illustrated. With the best printing possible it is not to be expected that the beautiful detail of artistic electric designs can be shown to advantage on paper. Contractors are invited by the company to pay a visit to one of their many showrooms, where the fittings can be seen wired ready for lighting up.

(To be continued.)

OVERHEAD CONSTRUCTION.

By ROBERT N. TWEEDY.

(*Concluded from page* 654.)

Too much emphasis cannot be laid on Mr. Sayers's remarks concerning the waste of money spent on insulated turnbuckles, Brooklyn strains, and the like—waste which is due again to the inertia of custom. Presumably, engineers call for these in their specifications, or pass them in the specifications which contractors send them, or they would not continue to be put up. Not only are they a waste of money. initially, but they continue to waste money all their lives Insulated turnbuckles, for instance, must have been the particular invention of the Evil One if the trouble they give is any indication of their origin.

When making shackles for reel insulators, care should be taken to shape them as in the full lines in the figure. Sometimes they have been made straight, as in the dotted lines, and failures have resulted. Several years' experience with reel insulators, where globes, brooklyns, and turnbuckles had been in use, have proved them entirely satisfactory, even in the hardest weather: mechanical and electrical failures being almost unknown.

Not everyone with knowledge of a tramway, after construction has been completed, could say in this year of grace:—"The soldered ear is the best form of attachment for the trolley wire. . . . The use of figure-8, or grooved section, makes the mechanical ear satisfactory, but such wire is at once more expensive and more troublesome to erect, *so that the balance of advantage remains with the soldered ear*," and, of course, circular wire. The greatest part of the maintenance of overhead work is due directly to circular wire, just as the life of the rails hitherto has been that of the joints, those points of fatal weakness. Until a perfectly smooth path is provided for the trolley-wheels by the removal of the ear from contact with them, the heavy depreciation of the trolley wires at every point of suspension will continue, and this must be for so long as ears are soldered directly on to circular wire. Figure 8 wire would be the salvation of many a line in England, and the difficulties of erection are traditional only.

In connection with the wear of circular trolley wire which is soldered to ears, the following remarks by a lineman named H. Dudgeon are exceptionally interesting. The observations made by him on a particular system covering many miles might have been made on a hundred and one English lines, for the conditions producing the effects noted are universal where circular wire is in use.

"I found that the ears seemed to wear irrespective of the way they were suspended—either rigid, span or pull-off—but that the wear varied according to the gradient of the road, the number of cars using it, and the type of ear. On a level road, both ears on the same span wear alike, but on a a hill those on the up line wear worst, and the steeper the hill, the more wear on the ears. On —— Hill, where I changed all the ears on the up line, the trolley wire under them gauged at best to size 3, but under some to as small as size 5 S.W.G. *This is the arcing style of wear.* The arc is not caused by any kicking of the trolley-wheel owing to the ear being rough, for the ears removed from this hill were worn so smooth that it was difficult to tell which was ear and which was wire. A rough ear, such as a new splicing ear, does cause a lot of arcing, especially on a hill, but this arcing tends to level the ear, though when the ear is levelled the excessive wear on it does not stop.

"The actual cause of the wear is, I believe, that the trolley-wheel when running on an ear does not get enough contact to carry the current properly. You will have noticed that among a lot of old trolley-wheels there are seldom two worn alike, though there is a groove common to them all which fits the trolley wire when clear of the ears.

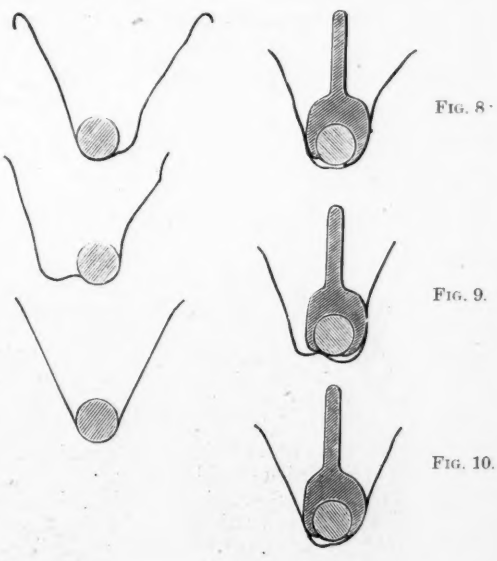


Fig. 5. Fig. 8.

Fig. 6. Fig. 9.

Fig. 7. Fig. 10.

In this groove contact is made with from one-quarter to one-third of the trolley wire, but at the ears the wheel only touches at two or three points." [This is shown in the figures above, which are interesting also as demonstrating graphically the divers shapes into which wheel grooves wear.]

"If the car is using a lot of current this contact area is not enough to carry it comfortably, with the result that the parts of the ear where the wheel touches, or the parts very close to where it touches, get burned away, or the metal

gets deteriorated and the succeeding wheels cut it away." Dudgeon found by "raddling" the ear and so marking the groove wherever it touched that the real areas or lines of contact between wheel and ear are even less than they appear to be when the sections from which the figures have been made were placed on the ear, and the figures themselves give an exaggerated idea of the areas in contact. On the other hand, the ear itself is not a good specimen.

"This style of wear [the 'arcing'] will go on as long as the ears are thicker than, or overlap the trolley wire.

"Regarding the 'bumping' wear, this is, of course, caused when the trolley wheel comes to a rough or lumpy ear. On an uphill line arcing tends to level rough parts, but on a

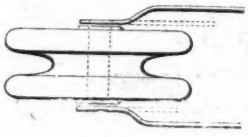


Fig. 11.

down hill where no current is needed these rough parts go from bad to worse. The metal of the ear is not removed, but on the underside the wire gets hammered out into little waves, and I have seen the wire hammered up round the edges of the ear like gold leaf.

"On ordinary ears this style of wear is not of much consequence, and I believe that by dressing the points taper and the body smooth, it can be avoided, but on splicing ears this hammering tells very badly, and soon causes them to be

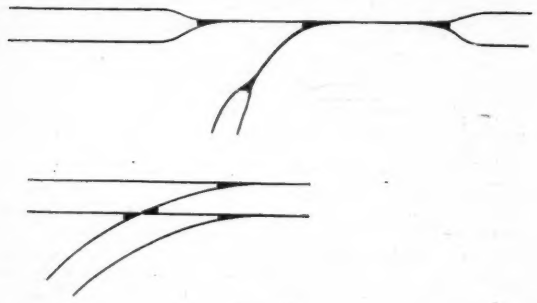


Fig. 12.

scrapped . . . . The trolley wire clear of the ears gets practically no wear except where it is out of alignment with the track, and the fixed trolley heads rub it away.

"To remedy the wear at the ears the only plan is to make them so that no part is thicker than, or overlaps the wire, so that the wheels will make contact in the same groove as when they are on the free wire." He arrives at the conclusion that there is no ear on the market which will effect this, he condemns wholesale all mechanical ears for circular wire, and he says that the older type deep-grooved ear is much worse for the wire than the shallower-grooved ear which is in more general use.

Now, those observations coming from a man with brains as well as eyes in his head, who lives day and night, one may say, amongst ears and trolley wires, are particularly valuable, and the reasons and conclusions are generally sound. They lead us clearly towards figure 8 wire, unless some improvement can be made in the design of soldered ears.

Mr. Sayers continues:—"It is doubtful whether the small lugs which it is usual to provide at the ends of the ears for hammering over the wire serve any useful purpose." That is so, and far from being of use they provide the very lumps which cause "bumping" wear. Judging from the almost insuperable difficulty of persuading makers to supply trolley wire fittings of any kind under which it would be possible for a wheel to run smoothly, one is not surprised to find lugs and such like lumpy horrors, on ears. That the makers of overhead work should be so ignorant of or indifferent to the elementary necessities of the case, argues poorly for the knowledge of their instructors, who are, as always, the users, or else tells a tale of obstinacy on the maker's part which it would be difficult to credit.

When Mr. Sayers says that 15 in. is the minimum length for an ear, and that the advantage of increasing this length up to 24 in. is doubtful, he has original construction in mind, and his opinion is acceptable; but during the working life of the line, ears even up to 36 in. may have to be used. This necessity arises from the wear of the wire at the ends of the ears; and in order to cover these weakened parts, a succession of ears gradually increasing in length has to be fitted. This is much to be preferred to cutting the wire and putting in splicing ears, and it means that lengths of new trolley wire have not to be put up for a much longer period.

It is very nice to talk about ascertaining the best angle and position for an overhead crossing by plotting out the junction to scale and moving over it a template car and trolley boom, but when there are all kinds of cars running over the junction these drawing office positions are apt to put the draughtsman to shame. The only workable way to get crossings and frogs into the best position is by the tedious method of trial and error from the top of a tower wagon. Crossings have given a deal of trouble without a doubt, but the single line junctions with single wire construction which Mr. Sayers recommends have given more, and now that a certain and simple automatic crossing for all angles can be bought, there is not the least reason for using that construction in future.

When a tramway engineer is told that Bates fuses are to be preferred to quick-break switches in section pillars *because they have no troubles of their own*, he is not unlikely to smile. They are as full of troubles as a decent quick-break switch is free of them. The Bates fuse is an excellent fuse when it is not given more to do than it ought, and that is just what has been done when it has been put into tramway feeder pillars. It has been made too small, and an exceptional short circuit or a long sustained overload has been the death of many a one. Probably, the balance of opinion is on the side of fuses rather than switches for section pillars, but the fuse must be capable of dealing with the heaviest duty without damage to its receptacle. Then, again, we shall never believe that lightning arresters are so bad that the one recommended in the paper is the best. The fact is, that no arrester with moving parts is in the running with arresters which have no movable thing about them, and that, the writer can prove with the bodies or the ghosts of dozens of the plunger variety.

Last week a terrific thunderstorm passed over a certain tramway. One flash passed to earth through a plunger arrester—and left a charred lump behind; another, and several more roused the echoes in a power station as they flashed across stationary arresters on the outgoing feeders, and every time the arresters asked for more.

There were once two plunger arresters set to guard the cables in a section pillar on high ground. A storm came, lightning flashed, the line was put to earth, and the cars were stopped until the earth was removed. Three cables out of four had been shorn off clean at the entrance to the bell-mouth of the pipe, and the arresters were no more.

As for the method of running "side-feed" cables, which the author considers good, the writer can say without hesitation that it is one of the many things which looks flawless on paper to anyone who has not the necessary experience to criticise it, keeps flawless perhaps for a year or two after construction, and then fails lamentably. By the time that happens, the man who designed the arrangement is out of touch with the job, and hears nothing of the objections which have arisen.

The method favoured by Mr. Sayers is to cut an oval hole about 4 in. × 5 in. in the pole about 1 ft. below the ground level and bolt a 3-in. quarter bend to it, one end of the bend passing through the hole into the pipe, and the other end being joined to the pipes which carry the cables into the section pillar. The side feeders are drawn into flexible steel tube and are then drawn into the pole through the bend.

Now, that works delightfully for a time, and doubtless would continue to do so, if a nice little ventilating and drying fire could be kept going at the bottom of the feeder pole always; but, most unfortunately, under the harder conditions which really exist, moisture is present inside the pole in quantities depending on the condition of the atmosphere and other things, and, first of all, the flexible

armouring starts rusting, while the bend at the foot of the pole gradually fills with water. The rest may be left to the intelligent reader's imagination.

Time after time these side feeders have broken down, and upon every occasion the cause has been traced to the action of water.

Until moisture ceases to be deposited inside poles, side-feeder cables ought not to be armoured in any way, and if they are carried in pipes from pole to box, those pipes ought to be filled solid with bitumen or something equivalent to it.

Wherever circumstances permit, the easiest and safest arrangement is to set the feeder box a few inches only from the feeder, and to pass the side-feed cables into the pole through a short horizontal pipe near the top of the box. Thus the cables are raised clear of flooding, and are more within reach than when diving below the ground level.

The working life of overhead equipment provides a fascinating study for all tramway engineers, and it is a thousand pities that it is not pursued more ardently. There is too much inclination manifested to let the lineman supply all the information, and not to verify and investigate personally.

ARC LIGHTING.

A LECTURE was announced to be given at the Electrical Exhibition at Olympia on Tuesday, October 17th, by Mr. Frank Bailey, M.I.C.E., on "Arc Lighting." We understand it was intended to illustrate this lecture by a series of demonstrations; but, owing to the use of the room being required for other purposes during the day, there was no time to carry out the necessary arrangements. In the absence of lantern projections of the arc, and the spectrum of the light given by various types of lamps and of flame carbons, the lecture was altered to a short discourse on the history of the arc, and its present position as a method of illumination, particularly as compared with the cost of street lighting by modern gas methods.

After explaining the discovery of the arc by Sir Humphrey Davy 100 years ago, reference was made to the ever-recurring absurdity of describing electricity as being in its infancy, and a large number of modern arc lamps which had been hastily erected in the room enabled the audience to appreciate the inference that the "infant" was in a most thriving condition. The lamps were of the following types:—Bastian, Verity, Brockie-Pell, Crompton, Jandus, Reason, Lewis Patent, Excello, Santoni and Maxim.

The general principles of the arc lamp were discussed and illustrated by means of a large wooden model. Reference was made to both continuous and alternating currents, and the peculiarities of the latter were demonstrated by the familiar method of rotating a wheel at certain harmonic speeds to synchronise with the alternations. The perfection of the modern arc lamp was mentioned, and full credit given to the skill and ingenuity of the present makers, who had utilised the large fund of general knowledge on the subject; and although the arc lamp of to-day presents no new features, but a wise selection of old devices, it now gives a result so perfect that it can no longer be described as a "sickly, green, uncertain light" which was quoted from some verses which appeared 20 years ago in one of the comic journals, and which the lecturer recited.

Various historical arc lamps were referred to, the Rapieff lamp of 1877, being quoted as containing many of the leading features which have been adopted in the modern lamp, including inclined carbons with contacts to the carbon rods close to the arc, the magnetic deflection of the arc and the magazine for the automatic supply of carbons. Flame carbons were then mentioned, and a hope was expressed that they would shortly be cheaper in price, as it was difficult to believe that any Patent Rights on general principles could be upheld. In 1857 Harrison was using a combination of carbon and metallic salts, and appears to have found that lead fluoride and sulphide of copper, while giving a fine green light, also gave off a copper vapour mixed with fluoric acid, which was not altogether healthy, and in 1879 Hamel described hollow cylindrical carbons, which appear to have been the forerunner of the cored carbon of to-day. The Bremer carbon was, therefore, constructed with considerable assistance from prior knowledge and experience.

After a description of the enclosed arc, a demonstration was shown of a mercury vapour lamp of the Bastian type, and its characteristics were explained with the assistance of a coloured screen to show the absence of red rays and how this deficiency had been successfully overcome by the ingenuity of the makers.

Various experiments with flame carbons were described, and it was stated that multi-coloured carbons could now be made so as to indicate to citizens the period of the night. White was suggested as a convenient colour from sunset to 8 p.m., then yellow until midnight, after which time red could be used for one hour, so as to give people time to reach home without any serious charge of dissipation, or being under the illumination of the green light from the selective carbons.

Dealing with the question of street lighting, Mr. Frank Bailey stated that his remarks were made entirely on his own responsibility, and must not be considered as emanating from an official of any company.

Mr. Bradley's well-known tests at Westminster were referred to, and from tests actually taken in the City of London the following figures were mentioned, the cost of the gas lighting being taken from the *Journal of Gas Lighting*:—

	Candle-power.	Average total cost per C.P. per annum.
Gas.—Double burner, ordinary low pressure incandescent (mean of six tests) ...	129	11·1d.
Single burner, high pressure gas ...	150	9d.
Double burner " " " ...	244	11·7d.
Arc Lamp.—Old lantern	659	8d.
Flame arc	1,317	5d.

It must be noted, however, that whereas the cost of the electric arc is quoted, including all charges of maintenance, and interest and redemption of capital, in the case of the gas lamp the cost is solely for maintenance charges, that is to say, the supply of gas and mantles only, and it does not include any portion of the capital cost of providing posts, mains, or fittings; and further, the hours per annum for the use of electric arc are fixed at 4,473, but the hours of burning adopted for the gas lighting have been observed to be less.

These tests were made on a clear night under normal conditions. The candle-power measurements were in each case taken at a horizontal distance from the light equal to twice the height from the ground level, thus enabling positions to be taken whereby the lamp measured was the only light in line with the photometer screen. Photometer measurements were made with a Flicker photometer mounted in a van with an aperture in the end. An incandescent electric lamp controlled by an adjustable rheostat, voltmeter and ammeter was used as the standard, and this lamp was standardised immediately before tests by means of the Pentane and the Fleming standards. Heights and distances were directly measured by a steel tape; angles were read off the photometer head by the focussed light rays from the light tested. Readings were taken by three observers, and every precaution was taken to ensure accuracy.

The difference between candle-power and illumination was carefully explained, the diffusion of light or general illumination depending not only upon the initial candle-power of the source, but also on the merits of the globe or lantern, the height of the lamp, the reflection from buildings, and the characteristics of the spectrum of the light for general diffusion.

From these tests of candle-power we can estimate the illumination at a distance of 100 ft. from the source as follows:—

Double ordinary incandescent gas lamp illumination	·013	candle-ft.,	ratio 1
Single H.P. incandescent gas lamp illumination	·016	"	= 1·24
Double H.P. incandescent gas lamp illumination	·027	"	= 2·10
Ordinary arc lamp	·060	"	= 4·50
Flame arc lamp	·120	"	= 9·0

The audience were invited to judge for themselves by walking along Fleet Street, and then from Blackfriars Bridge up Queen Victoria Street to the Mansion House. Flame arc lamps have been erected at Blackfriars, and a magnificent illumination can be seen any evening outside the Mansion House from similar flame arc lamps, but the intervening space is lighted, but not illuminated, by a string of gas lamps, a few of which are only temporarily fixed, and are therefore not included in the tests. These gas lamps are placed at a very low elevation and light up the pavement and kerb, but fail to illuminate either the street or the buildings; in fact, they only act as pilot lights to show the position of the kerb; the upper storeys of the buildings are left in doleful gloom, and the police cannot see if the windows have been left open or if burglars are at work. This gas lighting provides no security for the citizen or his property, for whereas every arc lamp has been described as a policeman, the constable on his beat cannot see the neighbouring constable on duty in these gas-lighted thoroughfares.

Compressed gas was described as compressed impudence, and it was difficult to believe that the lighting of the streets of the city of the greatest capital in the world is satisfactorily or even adequately, and certainly not cheaply, carried out by the cooking of toy petticoats over a gas flame.

The mantles of the incandescent lamps were a source of considerable trouble and were frequently changed, and during the period of this changing of mantles, the lamps were, of course, put out of use, but it was surprising to note how little effect this cessation of lighting had on the general illumination.

Mr. Frank Bailey was anxious to point out that in making this trial of incandescent gas lighting the Corporation were performing a public service, and were worthy of all praise for their desire to secure a demonstration of the best that could be done with gas, but he appealed to his audience as to whether it was not equally desirable that the Corporation should enable those who could supply electric light, to submit to them the best examples of modern practice, and thus place the whole question beyond dispute, for at present it certainly appeared that the Corporation were anxious to give the gas interests every advantage, while ignoring the claims of the only method of obtaining a brilliant illumination at the lowest cost.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

20,330. "Improvements in arc lamp electrodes." The British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) October 9th.

20,335. "Improvements in protective devices for use in the distribution of electricity by overhead wires." J. Robson. October 9th.

20,344. "Improved electric high-tension distributor for internal combustion motors having two or more cylinders; also clip for fixing motors to frame of bicycles." J. J. Barter. October 9th.

20,347. "Apparatus for mechanically and electrically controlling the working of overhead and rail points on electric railways and tramways." A. Lustgarten and J. G. Jones. October 9th.

20,368. "Improvements in or relating to single-phase commutator motors." V. A. Fynn. October 9th.

20,371. "Improved apparatus for sound transmission by means of electrically produced light and heat rays." Siemens Bros. & Co., Ltd. (Siemens-Schuckert Werke, G.m.b.H., Germany.) October 9th. (Complete.)

20,392. "Improvements in or relating to electric motors." A. F. Pieper. October 9th. (Complete.)

20,402. "Improvements in direct current dynamo-electric machines and motors." A. H. Midgley and B. Reed. October 10th.

20,435. "Improvements in flame carbon arc lamps." Veritys, Ltd., and F. S. Worsley. October 10th. (Complete.)

20,441. "Improvements in inclined carbon arc lamps." Veritys, Ltd., and F. S. Worsley. October 10th. (Complete.)

20,467. "Improved signalling apparatus for single line sections of electric railways and tramways." C. D. Abel. (Siemens Schuckertwerke G.m.b.H., Germany.) October 10th. (Complete.)

20,496. "Improvements in or relating to telephones and telephone systems." A. J. Boult. (C. E. Egan, United States.) October 10th. (Complete.)

20,500. "Improvements in mercury electrolytes." H. S. Hadfield and The Reason Manufacturing Co., Ltd. October 10th.

20,512. "Improvements in or connected with the caps and contacts of electric incandescent lamps." M. Favero. October 10th.

20,515. "Improvements in electric arc lamps." W. J. Davy. October 10th.

20,542. "Improvements in electric cooking apparatus." H. Bevis and C. H. Archer. October 11th.

20,547. "Improvements in a system for the transmission of electric currents." I. Kitsee. October 11th. (Complete.)

20,548. "Improvements in the transmission of intelligence with the aid of electric energy." I. Kitsee. October 11th.

20,593. "Improvements in annunciators for telephones." A. L. Peterson. October 11th. (Complete.)

20,595. "Improvements in and relating to electric switch fuses." C. W. Atkinson and E. Garside. October 11th.

20,599. "Improvements in and relating to electric switches or cut-outs." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) October 11th.

20,609. "Improvements in electric arc lamps." F. M. Lewis. October h.

20,657. "New or improved duplex telegraphy." A. Minkley and W. J. Bakewell. October 12th.

20,666. "Improvements in electrical distribution systems." G. C. Marks. (J. Roberts, Cape Colony.) October 12th.

20,681. "Improvements in chains for use in supporting or ornamenting electroliers and other purposes." J. Dugmore. October 12th.

20,687. "Improvements in safety devices for overhead electric conductors." E. Giraud. (Date applied for under Patents Act, 1901, October 31st, 1904, being date of application in France.) October 12th. (Complete.)

20,690. "Improvements in electrical block signalling apparatus." J. McIlwain and C. A. Bennett. October 12th.

20,728. "Improved means for facilitating the erection of telegraph poles and the like." J. R. Brown. October 13th. (Complete.)

20,737. "Improvements in insulating materials for covering electric cables and the process for making same." H. Markus and The Barnwell Machine Co., Ltd. October 13th.

20,742. "Improvements for hand operated brakes on electrically-driven cars." Fitz-Roy O. J. Roose. October 13th.

20,749. "Improvement relating to overhead current collectors for electric railways and tramways." Siemens Schuckertwerke G.m.b.H. (Date applied for under Patents Act, 1901, October 27th, 1904, being date of application in Germany.) October 13th. (Complete.)

20,756. "Improvements in or relating to the suspension of rotating apparatus and magnetic compasses." H. Anschutz-Kaempfe. (Date applied for under Patents Act, 1901, March 25th, 1905, being date of application in Germany.) October 13th. (Complete.)

20,769. "An improvement in the application of alternating current to electro-metallurgy." V. Mitkevitch. October 13th.

20,770. "Improvements in cathodes." H. S. Hadfield and The Reason Manufacturing Co., Ltd. October 13th.

20,772. "Improvements in alternating-current collector motors." Aktien-Gesellschaft Brown, Boveri & Cie. (Date applied for under Patents Act, 1901, October 19th, 1904, being date of application in Switzerland.) October 13th. Complete.)

20,805. "Improvements in or in connection with trolley poles of electric tramcars and like vehicles." A. Entwistle and E. Entwistle. October 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1904.

Internal Insulation of Tubes and Fittings for Electric Conduits. Taylor. 19,423. September 9th.

Apparatus for Supplying Alternating Electric Current. Berry. 19,748. September 13th.

Starting Resistances for Electric Commutator Motors. (Date applied for under International Convention, September 16th, 1903.) Lator. 19,822. September 14th.

Vapour Electric Apparatus for Rectifying and other purposes. Carolan. (General Electric Co.) 20,553. September 23rd.

Electric Lighting of Trains. Leitner and Lucas. 21,144. October 1st.

Blowing Magnet Arrangement for Arc Light Lamps. Beck. 22,511. October 19th.

Manufacture of Composition or Compound for Brushes of Dynamo-Electric Machines for Bearings and for Other Articles. Morgan Crucible Co., Ltd., and Spiers. 22,659. October 20th.

Electric Power Transmitting Mechanism Applicable to Motor Vehicles and Other Similar Purposes. British Thomson-Houston Co., Ltd., and Hopps. 22,817. October 22nd.

Devices for Automatically Operating the Points and Switches of Electric and Other Tramways and the like from the Vehicles. Jones and Jones. 23,015. October 25th.

Contact Breakers for Overhead Systems of Electric Traction. Mitchell. 23,093. October 26th.

Magneto-Electric Apparatus for Ignition Purposes in connection with Internal Combustion Engines. Holden. 23,438. October 31st.

Magnetic Brakes for Railway and Other Vehicles. Braun. 23,885. November 4th.

Electric Accumulators. Mouterde. 24,166. November 8th.

Apparatus for Raising and Lowering Electric Arc Lamps. Mason. 24,828. November 16th.

Space Telegraphy. Stone. (Date applied for under International Convention, February 13th, 1904.) 28,826. December 29th.

Sparking Plugs. Dossetter. 12,760. June 6th.

Electric Hand-Switches for Motor Cycles and Other Like Purposes. Janes. 19,326. September 7th.

Electrical Systems of Railway Signalling. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,890. September 15th.

Time-Consuming Mechanism for Operating Electric Cut-Outs and Other Devices. Gardner. 20,496. September 23rd.

Braking or Stopping Devices for Electric Motors. Hultqvist. 20,970. September 29th.

Means for Automatically Compensating for Changes in the Voltage of Electric Circuits. Leitner. 21,145. October 1st.

Method of Regenerating Negative Accumulator Plates of Diminished Capacity, or for Avoiding the Diminution in Capacity of New Plates. Kieseritzky. 21,211. October 3rd.

Electricity Meters. British Thomson-Houston Co., Ltd., and Lloyd. 21,903. October 11th.

Dynamo-Electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,157. October 14th.

1905.

Electric Distribution Systems. A. J. Boult. (Entz.) 2,014. February 1st.

Electrical Mercury Switches Operated by a Vehicle Passing Along a Railway. Siemens Bros. & Co., Ltd. (Siemens & Halske Act.-Ges.) 6,073. March 22nd.

Electrical Connections. P. H. Jones. 9,101. May 1st.

Apparatus for Neutralizing Static Electricity. W. H. Chapman. 10,695. and 10,696. May 22nd.

Electric Telegraphy. I. Kitsee. 11,745. June 5th.

Distribution of Energy to Commutator Electric Motors from a Three-Phase Alternating Current Source. B. G. Lamme. (Date applied for under International Convention, June 30th, 1904.) 12,418. June 15th.

Vapour Electric Apparatus. Kruh. (Date applied for under International Convention, January 9th, 1904.) 370. January 7th.

Clip or Apparatus for the Screwing up or the Removal of the Nut or Ring used for securing the Shade or Reflector to Electric Lamp-Holders. Parry. 1,243. January 23rd.

Dynamo-Electric Machines. Serveau. (Date applied for under International Convention, January 26th, 1904.) 1,560. January 26th.

Carbon Brush-Holders for Dynamo-Electric Machines and Apparatus. Zingelmann. 3,135. February 15th.

Methods of and Apparatus for Insulating Electrical Conductors. British Thomson-Houston Co., Ltd. (General Electric Co.) 5,371. March 15th.

Drums or Reels for Electric Cables. St. Helens Cable Co., Ltd., and Kenyon. 5,680. March 17th.

Electro-Magnetic Speed Gear Applicable mainly to Automobile Vehicles and Boats. Soc. en Participation des Automobiles "La Magnetique." (Date applied for under International Convention, October 24th, 1904.) 6,469. March 27th.

Methods of Receiving and Indicating Electrical Impulses. Troy. (Date applied for under International Convention, April 8th, 1904.) 7,010. April 3rd.

Electrodes for Electrolysers used in the Manufacture of Bleaching Liquors. Kother. 7,020. April 3rd.

Points or Switches for Electric Tramways Working upon the Slot Conduit System. Connett. 8,931. April 27th.

Receivers for Electric Waves. Schafer. (Date applied for under International Convention, May 18th, 1904.) 10,097. May 13th.

Electro-Magnetic Ignition Device for Explosion Engines. Roos. 10,599. May 20th.

System or Apparatus for Automatically Releasing Electric Telegraphs. Ducretet. 10,629. May 22nd.

Telephone Exchange System. Dunbar. 11,290. May 30th.

Portable Electrical Measuring Instrument. Bourgeois. 11,673. June 3rd.

Electric Tremblers. (Date applied for under International Convention, June 13th, 1904.) Minoggia and Mere. 12,384. June 13th.

Electric Furnaces. Girod. 14,333. July 11th.

Points or Switches for Electric Tramways Working upon the Slot Conduit System. Connett. 15,590. July 29th.

Self-Releasing Brake Handles for Electric Tramcars and other Vehicles. Belmondo. 15,752. August 1st.

Electric Switches. Smith. 66. January 2nd.

Electricity Meters. British Thomson-Houston Co., Ltd., and Holden. 523. January 10th.

Electric Light Maximum Demand Alarm Relay. Wills. 2,980. February 18th.

Control of the Electro-Motors on Electric Railway Cars. Lydall. 4,529. March 4th.

Systems of Electric Transmission. Hilliard. (Date applied for under International Convention, April 20th, 1904.) 8,571. April 20th.

Means for the Electrical Regulation of the Speed of Internal Combustion Engines. De Dion and Bouton. (Date applied for under International Convention, December 23rd, 1904.) 9,257. May 2nd.

Process for Regenerating Electric Accumulators. Luckow. 11,353. May 30th.

Röntgen Tubes. Sterzel. (Date applied for under International Convention, July 11th, 1904.) 14,196. July 11th.

Polyphase Commutator Dynamo-Electric Machines. Elektricitäts Act-Ges. vorm. W. Lahmeyer & Co. (Date applied for under International Convention, July 11th, 1904.) 14,317. July 11th.

Distribution of Electricity for Electric Traction. Gibbs. 22,246. October 15th.

Systems of Control for Electrically-Operated Doors. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,818. October 22nd.

Alternating Current Electric Motors. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,819. October 22nd.

Contacts for Electric Controllers, Reversing Switches, and the like. British Thomson-Houston Co., Ltd. (General Electric Co.) 23,203. October 27th.